PLASTICS TECHNOLOGY

THE MAGAZINE OF APPLIED ENGINEERING

MARCH 1957

POLYSTYRENE FOAM INSULATION USED ON UNDERGROUND PIPING AT N.Y.C.'S IDLEWILD AIRPORT

See Feature Story, page 207

A BILL BROTHERS PUBLICATION

University of Michigan
Ann Arbor, Mich.
12/57

In sealing, potting and encapsulation—

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give excellent electrical, thermal and mechanical properties, plus—

Applying Epon resin sealing compound, formulated by Epoxylite Corporation, El Monte, California, to a 400-kva transformer winding at Larsen-Hogue Electric Co., Los Angeles, Calif.

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PLASTICS TECHNOLOGY

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Article

Highlights

Design for Better Calendering. (p. 187)
Calender design requires a consideration of the materials to be processed, their finished width, range of thickness desired, rate of production, degree of separating forces, roll operating temperatures, and power requirements. Intelligent design minimizes obsolescence.

•

Advances in Plastics for Automotive Body Manufacture. (p. 191)
The reinforced plastic car body is reviewed, with particular emphasis on recent innovations in manufacturing techniques. Also considered are the role of plastic tooling and the use of plastic substitutes for body solder.

•

Functional Selection of Plastic Materials —Part II. (p. 198)
Water absorption, impact strength, chemical resistance, sunlight exposure, tensile strength, compressive strength, flexural strength, hardness, and modulus of elasticity of plastic materials are discussed. The conclusion of a two-part article.

•

Load-Deflection Properties of Glass-Reinforced Plastic Laminates under Rapid Heating. (p. 203)
A test was devised for determining the effects which high loads and temperatures above the post-cure point would have on three-ply fiberglass-phenolic laminates. A short-term deformation results, which could make the part unusable.

Previews

The following articles will be published in the April issue:

Heat Stability Test for Vinyl Calendering Compounds. G. G. Himmler, development group leader, and F. R. Nissel,* Development Laboratories, Bakelite Co., Bound Brook, N. J.

Color Variations in Coatings for Plastics. M. A. Self, president, Logo, Inc., Chicago, Ill.

How To Select a Plastics' Brand Name. Milton E. Abramson, Examiner of Trademarks, United States Patent Office, Washington, D. C.

Heat-Distortion Properties of Polysulfide Polymer-Modified Epoxy Resins. Alan J. Breslau, section head, technical service department, Thiokol Chemical Corp., Trenton, N. J.

•

Letters to the Editor

Help Wanted from the Readers

Dear Sir:

I am enclosing, with some misgivings, my first attempt at a column on transfer and compression molding.

I have spent a good deal of time during the past five or six weeks talking with both material suppliers and molders in this industry. The general reaction, which is also my own, seems to be that there have been no new developments worthy of note for the past few years, and that the industry is destined for a gradually declining spot in the plastics industry. Here, at Auburn, we have found this to be very definitely the case, and 99% of our expansion over the past 10 years has been in the injection and extrusion fields.

Unless we get a good deal of reader response, I feel that it is going to be extremely difficult to get together enough material to keep this column going throughout the year. I have a few more notes which might be of some interest and would be a start towards a second column, but beyond that, at the moment, I have nowhere to go.

John Woodruff, President
Auburn Button Works, Inc.
Auburn, N. Y.

(This is the letter referred to in my editorial. Now, unless you readers doing compression and transfer molding believe this to be a dying field of plastics, let us have your comments to help John Woodruff continue his Forum subject. —Editor)

• • •

Wants Polyethylene Containers

Dear Sir:

I am looking for polyethylene containers having capacities of one, two, and three gallons. I would prefer a round shape, tapered to permit nesting. No top is necessary.

Would you kindly furnish the names of possible sources of supply?

B. Liquorman
Mohawk-Beacon Corp.,
Beacon, New York

(Suggestions are requested for transmittal to Mr. Liquorman.—Editor)

• • •

Styrofoam Trade Name Usage

Dear Sir:

We have noted with interest that y publication and your readers have h consistent followers of Styrofoam Dow plastic foam) and its applicatio one or more of the insulation, flo buoyancy, decorative, novelty, a packaging fields. We are very m pleased with your interest in this pro uct and are, therefore, asking your operation in helping us to solve perplexing situation now facing us.

Specifically, the problem is one clarifying some of the glaring incon tencies in the use of the brand na for this product.

Styrofoam is a registered tradem of The Dow Chemical Company and such, should always appear with a ca tal "S". We hope you will want to it correctly in this manner. However, realize that you will want to follow yo own editorial policy for such matte Generically, the material itself can properly identified as an expanded po styrene, a polystyrene foam, or a rig plastic foam.

Styrofoam has received a great de of attention in recent years in both t consumer and business press. We a proud of the outstanding properties Styrofoam, its growing list of appli tions, and the manner in which our c tomers and the public have accepted Naturally, we want to take every p sible precaution to safeguard this va able trademark.

Your cooperation will be appreciat by all of us at Dow.

Arthur Smith, Jr., Directo
Public Relations Departme
The Dow Chemical Compa
Midland, Michigan

(We have printed this letter to show cognizance of the very real problem volved in safeguarding trademarks. O editorial policy is to capitalize all tra marks and brand names, and to inclu some chemical explanation of the pro uct involved. For example, Styrofo will be mentioned as "Styrofoam panded polystyrene."—Editor).

We invite letters from our readers for publication in these columns. Such letters may be of comment or criticism, requests for information, or of general interest.

"Quote . . . Unquote"

hemical Diversification

. . . 'diversified integration.' This typi- a trend in industry of companies in ious basic fields of endeavor recogniz- an opportunity in the field of chemi- s. We list among our MCA members, addition to basic chemical companies, h organizations as W. R. Grace, Gen- l Electric, and U. S. Steel.

"The chemical industry becomes harder d harder to pin down each year. Product velopment and production have boomed along with a growth rate roughly three nes as fast as all industry. Interestingly ough, the plastics segment is growing at rate five times faster than all industry!

"This growth is truly phenomenal. From aboratory curiosity early in this century, stics have moved into the select group billion-dollar-a-year industries with an- al production last year of four billion unds—more than 15 times the amount oduced in 1940 and almost 75 times the 22 total!"

Gen. J. E. Hull, President
Manufacturing Chemists' Association, Inc.
Washington, D. C.

• • •

he Value of Marketing Research

"In American business, one of the at- butes that changes a man from an dinary worker to a manager is that ility to inform himself. The progressive merican business man, to a rapidly in- easing extent, has formalized the gather- g of his information by establishing a ecial department for that purpose.

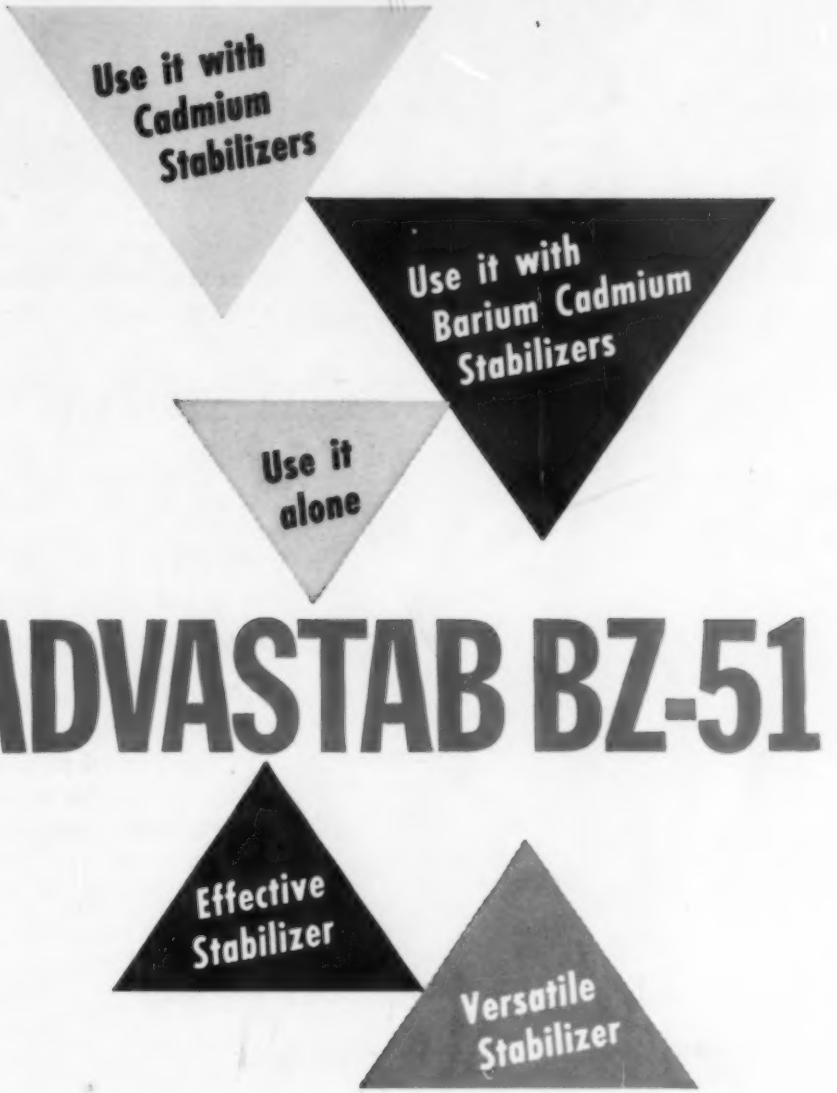
"The information produced by such de- rtments has received a variety of names, ch as 'commercial research,' 'business alysis,' 'operations research,' 'market udies,' 'motivation research,' 'trade anal- is,' 'market research,' and 'marketing search.'

"In the study of any market for prod- cts, we usually want to know: who will y what item, in what quantities, of what ality, at what price, in what kind of ckage, promoted in what kind of deal, ainst what kind of competition.

"Valid answers to these questions would ake it pretty hard to go wrong. Answer- g these basic questions thereby is the oper way to develop markets, and the ork involved is marketing research."

Gordon Brown, Vice President in charge of Marketing Research, Bakelite Co., New York, N. Y.

• • •



One of the most versatile and effective vinyl stabilizers yet developed, **ADVASTAB BZ-51** *can be used in a number of ways to achieve these outstanding results:*

- **Absolute protection from staining even under severest H_2S exposures — BZ-51 used alone**
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- **Outstanding initial color and clarity — BZ-51 coupled with Cadmium stabilizers such as ADVASTABS C-77, C-79 and JCX.**

Samples and technical data are available.

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NRM Devolatilizing EXTRUDERS

"Standard of the industry" for nearly a decade

INCREASE PROFIT ON PLASTICS PRODUCTION

3 WAYS BY ELIMINATING

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- **UNWIELDY PRE-DRYING ATTACHMENTS**
- **EXTRA PASSES THROUGH EXTRUDER**

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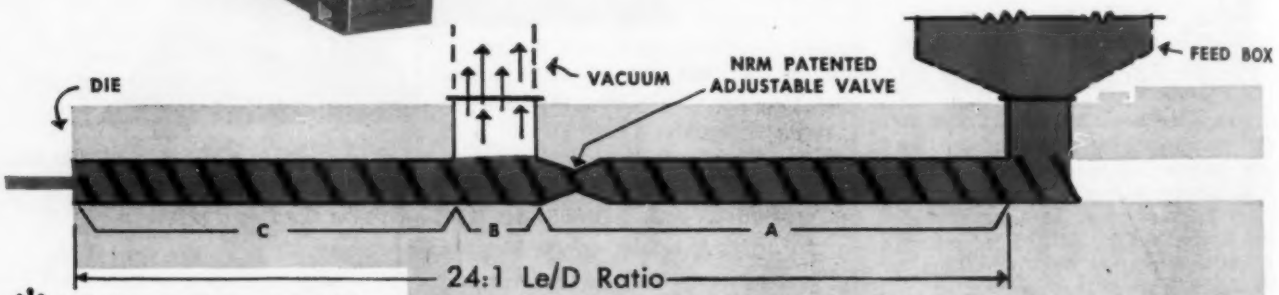

* *Volatile constituents in the plastic causing porosity are "vented" as follows: Plastic is heated, plasticized, and volatile elements brought to evaporation point in stage A. In stage B, plastic releases gases which escape through vent built integral with the cylinder. In stage C, material is further heated and worked, completing the extrusion cycle.*

WRITE TODAY FOR MORE DETAILS, QUOTATIONS, OR TO ARRANGE A DEMONSTRATION. THERE'S NO OBLIGATION.

2765

NATIONAL RUBBER MACHINERY COMPANY

General Offices and Engineering Laboratories: 47 West Exchange St., Akron 8, Ohio
EASTERN PLANT: 384 Getty Ave., Clifton, N. J.
SOUTH: The Robertson Company, Rutland Building, Decatur, Ga.
WEST: S. M. Kipp, Box 441, Pasadena 18, Cal.
MID-WEST: National Rubber Machinery Company, 5875 N. Lincoln Ave., Chicago 45, Ill.
CANADIAN: F. F. Barber Machinery, Ltd., 187 Fleet St., West, Toronto, Ont.
EXPORT: Omni Products Corporation, 460 Fourth Ave., New York, N. Y.

Creative Engineering

NEWS in BRIEF

The domestic chemical industry will spend an estimated $2.5-billion on new construction during 1957 and 1958, according to an MCA survey. Construction projects brought into production last year cost more than $1.4-billion, and totaled 354 of the 760 projects included in the survey. An additional 279 projects now under construction will cost about $1.8-million, and another 128 projects are definitely planned at an estimated cost of $717-million.

Structural design concepts for Monsanto's "House of Tomorrow" have been justified by a recently completed five-month test program. Monsanto, Winner Mfg., and Owens-Corning Fiberglas are cooperating to make available the engineering data developed by the testing and evaluation project.

Most instances of plastics misapplications have resulted from the simple, growing pains of the large, sprawling, comparatively new plastics industry, says A. R. Marusi, Borden vice president and president of the company's Chemical Division (see guest editorial, page 196). Commenting on our "Sharing Industry Responsibilities" editorial series of last year, he takes exception to some of our statements, but believes that our editorial views can serve as a useful guide-light for the industry.

Company expansions in the news columns of this issue number seven. Aerojet-General is expanding research, development, and manufacturing activities of its structural plastics group. Atlas Powder is building a $3-million technical center in Wilmington, Del. The Resinite department of Borden is doubling the size of its plant in Santa Barbara, Calif. Du Pont plans to build a third titanium dioxide plant near New Johnsonville, Tenn. General Electric has added new facilities to its Irrathene irradiated polyethylene plant in Pittsfield, Mass. Texas Eastman is increasing annual output of its polyethylene plant in Longview, Tex., by 55-million pounds. Union Carbide is building a research center in South Charleston, W. Va.

Company developments in the plastics industry are varied in nature. American Hard Rubber purchased the entire stock of Electric Mfg. Co., of San Francisco, Calif., maker of multi-color plastic moldings. Baldwin-Lima-Hamilton transferred the manufacturing and sales operations for its hydraulic and compacting press department from Eddystone to its Hamilton division, Hamilton, O. Beaver Paint has moved to a new plant at Lake City, Pa. Food Machinery & Chemical's new organic chemicals department assumed responsibility for the plasticizers made by its Ohio-Apex division. Foiltone Products, Inc., changed its name to NRC Vaculite Corp. Nicholson File purchased Danielson Mfg., makers of molded and extruded nylon products, which will operate as a subsidiary. Wooster Rubber bought Jamestown Finishing Products, and will operate it as Jamestown Finishes, Inc., a wholly-owned subsidiary.

New Materials worthy of mention (see pages 221-2): epoxy-impregnated glass cloth; reduced-cadmium pigments; two water-repellent epoxy hardeners; extrudable fluorocarbon resin; non-woven acrylic fiber mats; and a line of thermosetting and thermoplastic industrial adhesives.

New Equipment of special interest (see pages 224-5): skin packaging machine; electronic tramp metal detector; custom-calibrated thermometers; drilling tool for rigid plastics and laminates; mechanical pressure indicator; and lightweight model steam trap.

New Products to be noted (see pages 227-9): laminated vinyl wall tiles; vinyl-rayon fabric; glass-reinforced polyester truck cover; vinyl-carpet stair treads; rigid PVC slip-type expansion joints; polyethylene vacuum pouches; low-density polyethylene drum closures; impact-resistant polystyrene pans for flourescent lights; window gaskets and door frames of vinyl for super-market refrigerators; shatterproof, non-flammable windows of rigid vinyl; thin-walled, pressure-rated PVC pipe; and metallized rigid vinyl sheeting.

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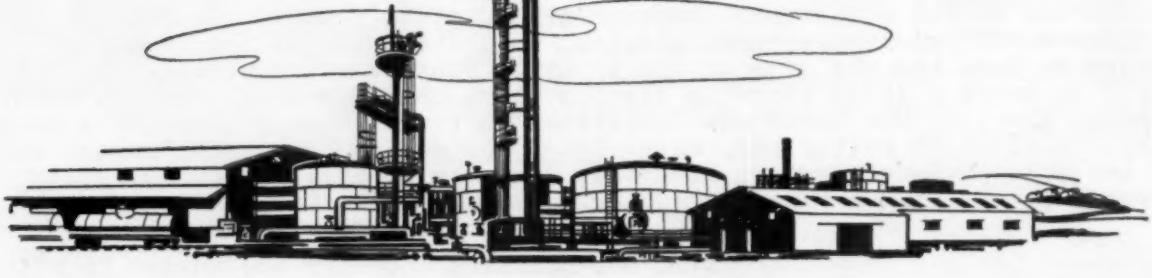

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PLASTICS TECHNOLOGY

MARCH, 1957

EDITORIAL: PT's Engineering Forum

With this issue, PLASTICS TECHNOLOGY inaugurates another new feature—the Engineering Forum. Present plans call for the Forum to cover six subjects: Reinforced Plastics, Moldmaking and Tooling, Compression and Transfer Molding, Injection Molding, Vacuum Forming, and Extrusion.

The first three Forum subjects appear in this issue, and every other month thereafter. Alternating with these will be the second group of Forum subjects; Injection Molding, Vacuum Forming, and Extrusion. This second group will begin in the April issue, although the Extrusion Forum will not be initiated until the June issue.

•

Various members of our Editorial Advisory Board will be conducting the different Forum subjects; in fact, they actually will be the editors of their respective forums. Harry Douglas, executive vice-president of Lunn Laminates, Inc., will conduct the Forum on Reinforced Plastics; Ernie Csaszar, vice-president of Eagle Tool & Mold Co., will conduct the Forum on Moldmaking and Tooling; and John Woodruff, president of Auburn Button Works, Inc., will conduct the Forum on Compression and Transfer Molding. In the second group of Forum subjects, Injection Molding will be conducted by Saul Blitz, president of Tico Plastics Co.; Vacuum Forming will be handled by Bow Stratton, president of Auto-Vac Co.; and the Forum on Extrusion will be the responsibility of Al Kaufman, president of Prodex Corp.

Each of these men has the widest possible leeway in conducting his Forum subject, and can discuss any phase of materials, equipment, and processing methods in his field.

We do not look upon the Engineering Forum as providing a convenient arena for acrimonious argumentation, but rather as a place where the problems confronting processors in the various fields can be aired and given sober, constructive discussion by an industry expert, with a view towards alleviating or obviating these problems.

•

Naturally, the interest and value of the Forum discussions will depend largely on the cooperation and degree of participation put into it by you, our readers. This is where your comments, thoughts, and opinions will receive careful attention and discussion. Each Forum editor will discuss the problems of his field, but he needs your participation.

In this connection, we would like to emphasize the special problems involved in the Forum on Compression and Transfer Molding, as expressed by John Woodruff and printed in the "Letters to the Editor" columns of this issue. John needs your assistance desperately if his Forum subject is to continue.

In addition to specific letters to the Forum editors, we also invite your comments on the Engineering Forum itself, the format employed, the subjects covered, and what additional subjects should be included in the Forum.

Arthur M. Merrill

Editor

Plastiatrics
DOW'S CLINICAL APPROACH TO HEALTHY PLASTICS APPLICATION

PRACTICAL ANSWER TO STATIC DUST COLLECTION

FIGURE 1

FIGURE 2

FIGURE 3—*Figures 1, 2 and 3 show typical static dust patterns on nontreated plastic surfaces as reproduced by Dow process using fluorescent pigments and "black light".*

DOW RESEARCH SHOWS HOW TO SPECIFY PROPER TREATMENT TO ASSURE DUST-FREE POLYSTYRENE SURFACES

FIGURE 4—*Here the same "black light" technique shows the absence of static charge on plastic surfaces destaticized by new method.*

Static electricity which attracts and holds dust has long been acknowledged a problem in the manufacture and use of plastic products.

To overcome this behavior, Dow Plastics Technical Service developed new techniques for obtaining, observing and recording dust deposits. With these tools, Dow research explored hygroscopic chemicals that render the surface hydrophyllic or, in other words, that destaticize it.

A method was developed and conclusively tested to provide freedom from static for long periods of time. This method includes dipping, spraying or otherwise coating moldings with a dilute detergent solution that reduces electrostatic charges to levels that prevent dust pickup.

FREE BULLETIN

A list of suitable compounds together with further information on this subject are contained in the bulletin, "Static Dust Collection of Plastics". Address: THE DOW CHEMICAL COMPANY, Midland, Michigan—Plastics Sales Department PL1540K.

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STYRON 440 (Heat Resistant)
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HEAT RESISTANT

STYRON 683
STYRON 700

YOU CAN DEPEND ON DOW

PLASTICS TECHNOLOGY

Design for Better Calendering

Discussion of the important design features that should be considered in order to minimize calender obsolescence

KENDRICK J. GOOCH, *Asst. Division Engineer,*
Mill & Calender Division,
Farrel-Birmingham Co., Inc.
Ansonia, Conn.

THE process of calendering is used primarily to densify, to size in thickness, and to produce a desired surface finish on a given material. This operation is performed between two or more pairs of rotating rolls. Each roll pair forms a rotating die through which the material is either drawn or extruded, or both.

Exactly what physical action occurs on plastic compounds as they pass between the rolls of a calender is not definitely known. However, considering that the material appears at times to be nearly fluid, we do know that amazingly large forces are required to keep the rolls together.

Design Factors

In designing a calender, the manufacturer is primarily concerned with the following seven factors:

(1) The material or materials to be processed.
(2) The finished width of these materials.
(3) The range of film or sheet thicknesses desired.
(4) The maximum rate of production required.
(5) If the compound is a new one, the degree of separating forces to be expected.
(6) The range of roll operating temperatures required.
(7) The power requirements.

Kendrick J. Gooch was born in Maine in 1919, and received a B.S. in mechanical engineering from Tri-State College, Angola, Ind., in 1941. From 1941-1942, he was a student engineer at Farrel-Birmingham, leaving to serve as a research and design engineer with the Navy from 1942-1945. Returning to Farrel in 1946, he served as a design engineer in the sugar mill division until 1948; design engineer in the roll grinder division from 1948-1950; lubrication engineer in the engineering department from 1950-1954; sales engineer for the mill and calender division from 1954-1956; and was appointed to his present position in August 1956. He is a member of ASME. Mr. & Mrs. Gooch have three children, and reside in Bethany, Conn.

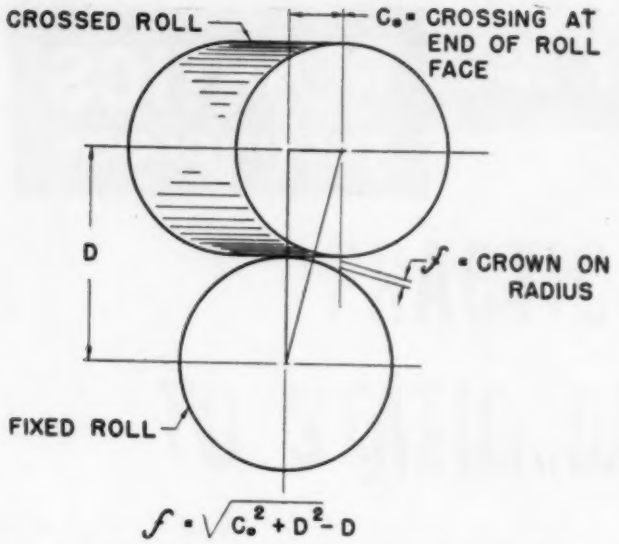

Fig. 1. Derivation of the formula for the relationship between amount of roll crossing and the roll crown thus produced.

Other factors for improvement of the calender from the operator's viewpoint can come under consideration as the design progresses, but the seven points listed above must first be settled for selection of the correct type and size of machine.

The ultimate aim in calender design is to create a machine which combines the following four features:

(1) Maximum rigidity of roll positioning to maintain maximum accuracy

(2) Greatest flexibility in the range of material types, and the film and sheet thicknesses which can be produced.

(3) An allowance for handling the future materials which, based on past experience, will require more power and greater roll stiffness.

(4) The accomplishment of the above features at a cost considered reasonable by the customer.

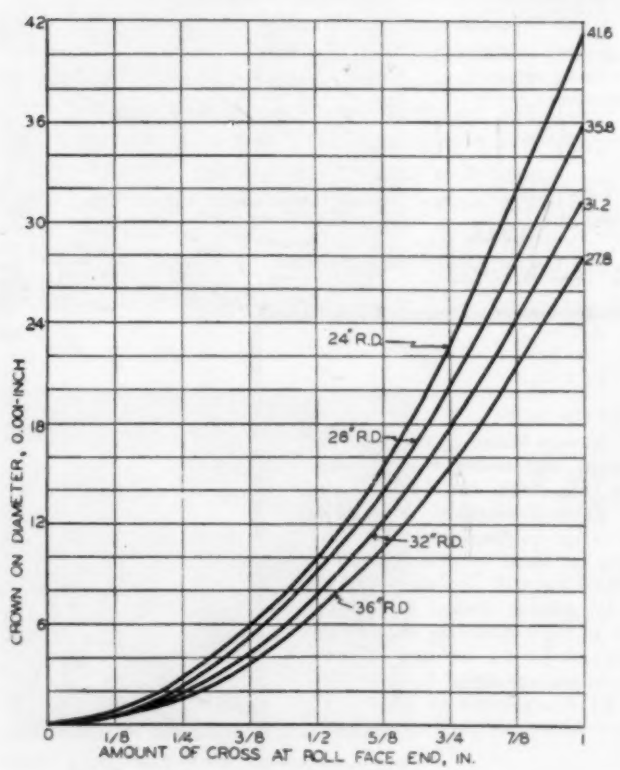

Fig. 2. Effect of amount of roll crossing on crown diameter for four standard calender roll diameters.

Effect of Material Type

Since new calenders were not readily obtainable when the plastics film industry was born, many of today's producers obtained their start on rather old rubber calenders. It was soon realized that plastic calendering was different from rubber, and that higher operating temperatures and better surface finishes were required. To meet these conditions, larger design clearances and flood lubrication were added. As the industry was developed and greater accuracy was required, other design improvements were made gradually. These included preloading, crossed roll axes, and the Farrel "Z" arrangement.

Then, the new rigid molding compounds appeared, bringing with them new design problems. Some of these compounds may be better handled with only two passes on a three-roll calender. Some require roll operating temperatures as high as 500° F., and the best friction ratios for calendering these compounds have not been determined as yet. Normally, allowance for an increase in power requirements is made by selecting a D. C. motor with full horsepower at a base speed about 30% below maximum calender speed. Recent information, however, indicates that the new rigid compounds will require full power at 50% below maximum calender speed.

From the foregoing, it is seen that the materials to be produced determine the following:

(1) Variations in separating forces per inch of face that can be expected.

(2) The number of rolls required.

(3) Friction ratios or range of ratios required.

(4) Maximum roll temperature and range of roll temperatures required.

(5) Power required in proportion to size.

Effect of Material Width

In addition to the material type, the calender designer is equally interested in the maximum material width. Through improvements in roll design, temperature control, and the material compound, the width of plastic film and sheeting rapidly increased from a maximum of 48 inches to 72 inches and wider. Calenders with a face of 108 inches have been considered seriously, and the maximum width will probably increase with the market demands.

Of course, as the length of the roll face increases, the separating force between the rolls also increases. For present compounds, roll faces exceeding 100 inches require roll diameters of 40-48 inches. These diameters are required to provide adequate roll strength and stiffness, and sufficient journal bearing areas. However, since the size and, therefore, the cost of calender increases rapidly in proportion to its roll diameter, one of the drawbacks to greater material width is readily apparent.

Effect of Sheet Thickness

The separating forces on calender rolls vary approximately inversely with the range of sheet thicknesses for a given compound. The size of a calender usually is determined by three factors; type of compound, width of sheet, and minimum sheet thickness. However, the range of sheet thicknesses to be produced also is an important design factor.

Few plastics calenders are designed today for a single-purpose operation. Maximum flexibility usually is desired so that both thin films and heavy sheeting can be produced as the market requires. This flexibility is obtained by varying the effective calender roll crown. The design methods currently in use for this purpose are crossing of the roll axes, and roll bending.

Much has already been said with regard to both of these methods. Since this feature is still of major interest and importance in calender design, however, the following information has been prepared to show the theoretical crown contours produced both by roll bending and by crossed axes.

Figure 1 shows the diagram used in deriving the formula for the relationship be tween the amount of roll crossing and the crown thus produced. This "crown" is crown on the radius, and must be doubled to give crown on the diameter (which is the common method of expression). Figure 2 shows a series of curves expressing this relationship for the standard roll diameters used in the plastic industry.

By modifying the formula shown in Figure 1 so as to express the opening "y" at various points "x" along the roll face, for a given amount of crossed axes "Co" and the corresponding "crown" on the radius "f", the formula for crossed axes roll crown contour is obtained (see Figure 3). The theoretical roll-bending crown contour is that produced by two couples acting on a uniform beam. This gives a curve which is an arc of a circle, and the circle formula in terms of "X" and "Y" is shown in Figure 4.

Based on these formulas, Figure 5 shows a comparison of the crown curves produced both by roll bending and by crossing the axes. These curves are for a radial crown of 0.004-inch on a 24 x 66-inch roll having no initial crown. They are practically identical in contour, the maximum difference being less than 0.00012-inch, according to computations. Both of these curves are also nearly identical with the theoretical deflection curve for this roll.

In actual practice, however, we do not have a theoretical roll. Even with drilled rolls and a circulating fluid temperature-control system, the rolls are a few degrees cooler on the ends when producing stock. Also, a roll is not uniform in cross-section, nor is it loaded exactly uniformly. The combination has resulted in the so-called "oxbow" sheet contour which is common to all calenders, including those in the rubber and flooring fields, both with and without crown compensation.

To compensate for these non-theoretical factors, the Farrel patented reverse crown roll contour has been developed. The amount of "reverse" varies with the size of roll and its application. The approximate contour which the 24 x 66-inch roll under discussion should have for actual operating conditions is shown in Figure 6. To obtain this contour, a certain amount of initial reverse crown is ground on the rolls before shipment.

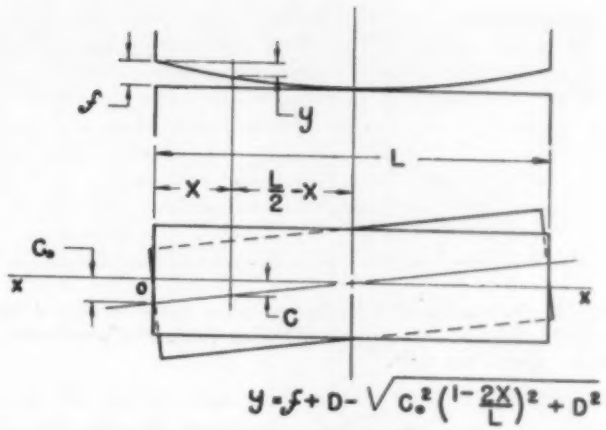

Fig. 3. Derivation of formula for crossed axes "crown" contour.

Besides the shape or contour produced by a variable roll crown device, the range of crowns which can be obtained also is important. The range of crown correction obtained by roll bending is limited by the maximum allowable bearing loads and rollneck bending stresses imposed by both the bending and the separating forces. The range of crown correction obtained by crossing the axes is limited only by the stresses resulting from the separating force.

Roll Arrangement

Once the design specifications which determine the size of the calender have been settled, other features should be determined, such as the general arrangement of the calender for ease in threading, accessibility of the rolls, and general convenience of the operator. The Z-type calender has now been in use by the plastics industry since 1946, and this roll arrangement has become an accepted standard. Recently, a new calender design called the Inclined-Z has been developed, as shown in Figure 7. Note that the basic Z-roll arrangement, which permits free roll deflections, has been maintained. The inclined position, however, provides a clear and short path for material travel, and the embosser or other attachments can be placed close to the pick-off roll:

Material is now taken off the #3 roll, which is more accessible than on any previous design. Taking the material from the #3 roll is believed to be beneficial, since the side of the sheet next to this roll is uppermost for

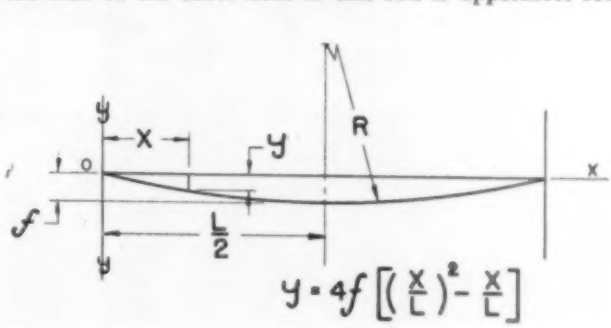

Fig. 4. Derivation of formula for roll bending "crown" contour.

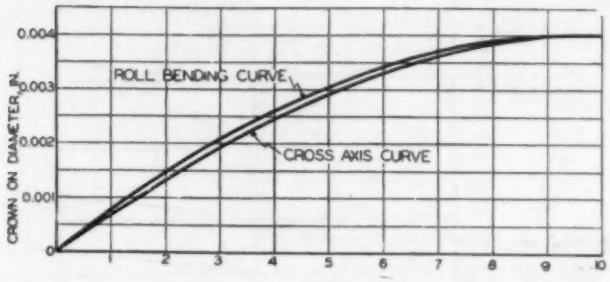

Fig. 5. Comparison of calender roll crown curves produced by roll bending and axes crossing. Abscissa (horizontal coordinate) is on an arbitrary scale.

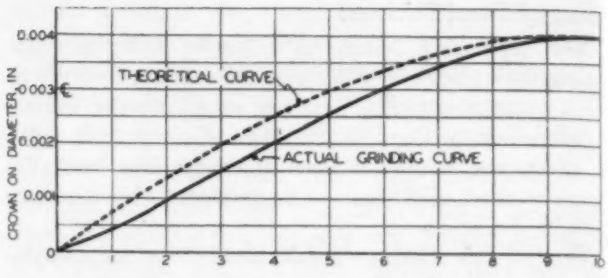

Fig. 6. Comparison of theoretical crown contour and Farrel reverse crown contour on 24 x 66-inch calender roll. Abscissa is on an arbitrary scale.

subsequent embosser or polishing rolls in the calender train. This side of the sheet normally has the better finish because it is constantly in contact with the #3 roll and, therefore, is less disturbed by the rolling bank between the #3 and #4 rolls.

The arrangement also permits the calender to be used as a three-roll unit without reversing the calender train. This is a desirable feature, since, as mentioned previously, some of the newer rigid materials are reported to calender better with only two roll passes. Also, the same direction of travel can be used for sheeting as well as for coating or laminating. Four Farrel Z-calenders with this inclined roll arrangement are now being built; two for plastics, and two for rubber.

Variable Roll Friction

The early calenders designed specifically for plastics had even or 1:1 friction on all passes. These roll frictions were later modified to 1.15:1 on the first pass, 1.03:1 on the second pass, and 1.03:1 or 1:1 for the last pass.

The operation of present calenders has been restricted by these friction ratios, and nearly all compounds have been formulated to suit these fixed roll frictions. To overcome this fixed friction problem, new calenders should be built with a separate motor drive for each roll. This drive arrangement would permit a wide range of roll friction ratios which can be preset and controlled electronically in a manner similar to that used currently on the sections of a calender train. One of the important advantages of this drive is the ability to increase stock temperatures by developing molecular friction through the use of higher-than-normal roll friction ratios.

There are two designs for this drive at present. The first design employs large gearmotors connected directly to the rolls through universal spindles. The motors are mounted on a special, welded-steel stand, and for this arrangement the motor diameters cannot greatly exceed the diameter of the rolls.

The second drive design is a semi-Uni-Drive arrangement which has the following two advantages:

(1) Instead of being a planetary gear set included in the gearmotor, the final, heavily-loaded gear reduction consists of wide-faced, double cut helical gears rigidly mounted in a heavy, welded-steel case.

(2) The gearmotors can be offset, providing easier, more accessible mounting and the possibility of larger motor diameters.

A calender incorporating both the Inclined-Z arrangement and individual roll drive has just been completed in our shops, and is shown in Figure 8.

This individual roll drive is not limited to production-size calenders. In fact, it would appear to be even more desirable for the laboratory-size unit.

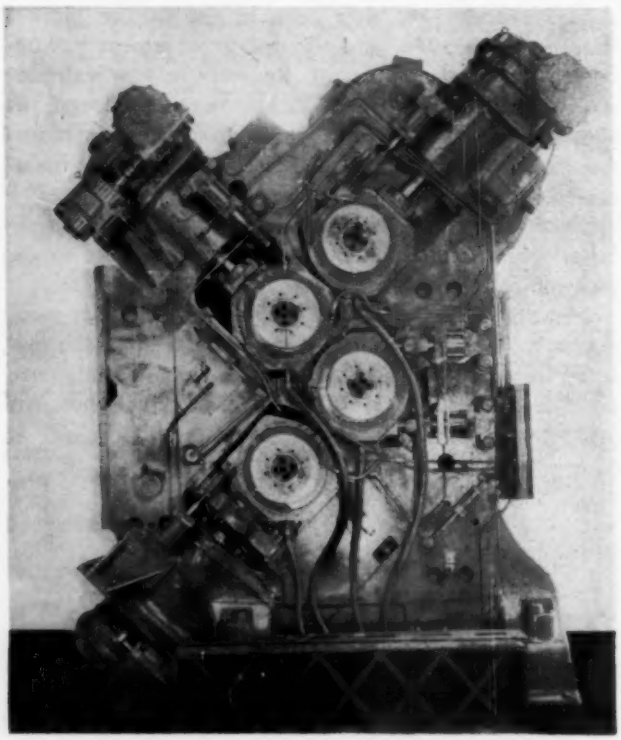

Fig. 7. Side view of new Inclined-Z calender design.

Conclusions

Many other items could be mentioned which are of

(Continued on page 207)

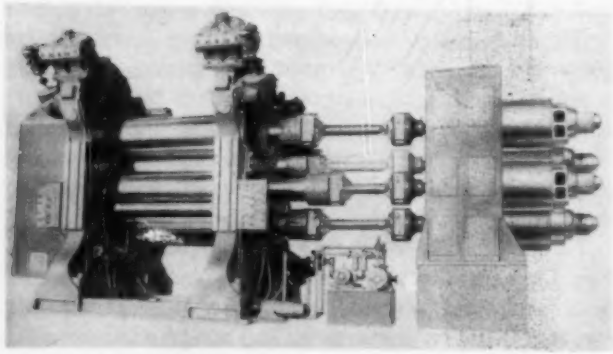

Fig. 8. Inclined-Z calender with individual roll drive.

Advances in Plastics for Automotive Body Manufacture

The roles played by plastics in automotive body bonding, tooling, and body solder replacement.

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IN recent years, plastic materials have assumed a position of remarkable significance relative to the manufacture of automotive bodies. Nothing has more profoundly influenced body tooling and production methods than the advent of the age of plastics. Numerous discussions have been written and presented dealing with the application of plastic panels as finished product components, and the use of plastic tools to implement body manufacturing.

This writing will review the reinforced plastic car body, with particular emphasis on recent innovations in manufacturing techniques. In addition, it will consider the roles plastic tools are playing and the inroads they are making in the field of tooling for body manufacture. A third significant, but still potential plastic development, that of the proposed body solder replacment, also will be traced and discussed.

Body Bonding Operations

The most significant departures from past practices .in reinforced plastic auto-mobile body manufacture have developed in conjunction with assembly plant bonding operations. Until recently, the method of attaching major body components consisted of riveting through external coach joint flanges after an asbestos-reinforced poly-ester bonding mixture had been applied to one or both pre-scuffed flanges.

The primary purpose of the rivets was to secure the joint during curing of the bonding material. This permitted handling of the parts without waiting for the adhesive to cure, so that the sequence of operations could proceed without interruption. Originally, it was felt that some contribution to the strength of the attachment was afforded by the rivets, but exhaustive tests have proved that the adhesive provides substantially all of the joint strength.

The recent complete model-redesign of major parts and, therefore, the panel break-up and bonding sequence described above, necessitated extensive revision of this bonding procedure. The external coach joint was eliminated and, while a joint between the upper and ower outer panels extending completely around the body shell was continued, it was styled to require

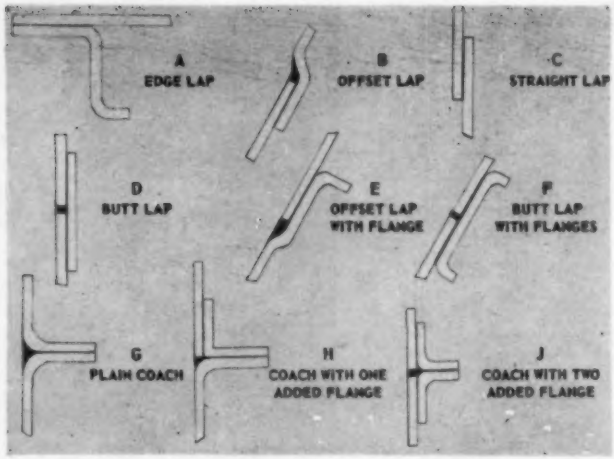


Fig. 1. Typical bonded assembly joints for automotive bodies.

patching so as to become invisible. Of importance too was the requirement that it remain invisible after lengthy time and mileage in service. These factors, together with some earlier bonded joints, stimulated a search for the strongest obtainable plastic joint which would be practical and acceptable to manufacturing groups.

The various types of bonded joints investigated are shown in Figure 1. Each of these designs has its particular qualities and deficiencies relative to cost, strength, and ease of assembly. The strongest joint, based on static and fatigue laboratory tests, which still is consistent with production feasibility, was found to be the channel-reinforced butt joint, F. This design is used, therefore, for joining the front upper panel to the underbody and rocker panels (see Figure 2).

Assembly and bonding is accomplished in bucks, upside down. Since no rivets are used, joints are secured with clamping blocks and pads until the resin bond hardens sufficiently to permit handling. In general, it can be stated that these new bonding operations are proceeding without difficulty in the plant where this model is produced. Any gaps in the joints on appearance surfaces are patched prior to painting, and cannot be detected even by very close examination after the finish is applied.

The importance of this development lies in the complete reliance on bonding and patching to obscure the joint. The methods described have been entirely successful, and since its durability was established before production was undertaken, no service deficiencies are anticipated.

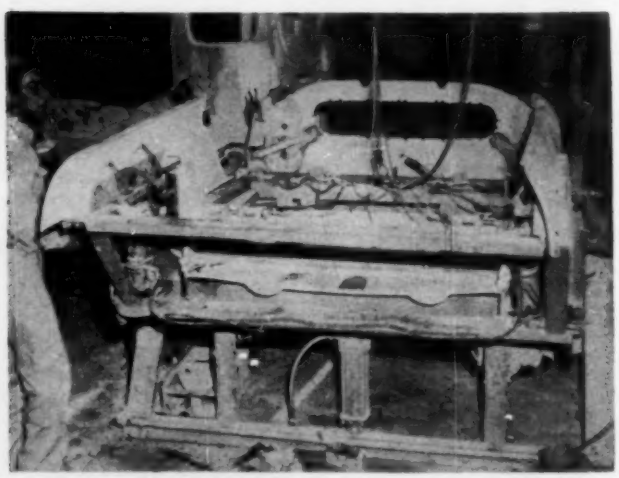


Fig. 2. Channel-reinforced butt joint is used to bond front upper panel of truck to underbody and rocker panels.

Another comparatively new development in reinforced plastic bodies arose in connection with the use of hangon fender panels for the ½-ton pick-up truck. The use of these hang-on fenders lends appearance qualities not generally obtainable or associated with the truck field. Since the basic cab is standard, these trucks are assembled at 11 different assembly plant locations. In the interest of plant space conservation, the plastic parts must be suitable for processing through regular "steel body" truck production facilities. Primer and enamel drying ovens operate at 275 F. and 250 F., respectively. The total oven cycle is somewhat variable, but is about 75 minutes.

In order to assure procurement of reinforced plastic parts which would withstand this cycle without warpage or deterioration, it was necessary to modify the laminate materials. Improved rigidity at temperatures up to 275 F. was specified at a slight sacrifice in low-temperature impact properties (which still are adequate), and resins resistant to heat crazing must be used. These measures have ensured entirely satisfactory operations on this model.

While the selection of reinforced plastics in preference to steel is confined to special cases where the economic factors are favorable, it has become a definite consideration in low-volume situations.

Plastic Tooling

This naturally leads us to an interesting paradox in the relationship of plastics to the automotive body building industry. It is a well-established fact that as we approach the point in terms of expected unit volume where the use of plastic body parts would be contemplated, we are also in the realm where metal-working tools made of plastics have proved satisfactory. These direct or primary plastic tools have been used successfully, both with or without metal inserts, to blank, form, draw, flange, punch, and trim sheet steel stampings.

Being much cheaper than steel dies, they naturally tend to lower the break-even volume point where it is economically sound to use reinforced plastic body panels instead of steel. Before elaborating on this beginning of a comparative discussion of plastic parts from steel molds versus steel parts from plastic dies, we should examine briefly the possibilities and accomplishments of metal working with plastic dies.

Opinions within the automotive industry vary widely as to the most reliable practices and materials for making direct plastic tools. Production experience also is variable between manufacturers, and even between different plants of the same manufacturer.

Dies and punches can be of cast phenolic, cast epoxy, laminated epoxy, pressure-cast polyester, or combinations thereof, to name only the most popular types. Each type has particular advantages with respect to material cost, time and equipment required for manufacture, accuracy of model reproduction, durability

and wear resistance, stability, and adaptability to complex or intricate metal working, to cite specific applications, the constructions of a cast epoxy trim die and a laminated epoxy re-strike die will be described in detail.

Figure 3 shows the re-strike die for a rear quarter extension panel, a part used only on a comparatively low-volume model. The steel draw die previously made did not provide satisfactory definition of certain lines and, because of a requirement for immediate correction, the plastic die was built. The plan was to use the plastic die as a temporary expedient, but when it proved to have adequate durability, its use was continued and eliminated the need for a new steel die.

The steps entailed in constructing dies of this type are as follows:

(1) An epoxy resin-surfaced and epoxy-impregnated fiber glass laminate consisting of 15 layers of cloth is made from plaster casts taken from the model. Bridge chaplets are inserted in the final ply to key the laminate to the cast plastic bonding layer.

(2) A rough contoured semi-steel shoe casting, having its surface relieved 1-1½ inches, is prepared for bonding to the laminate by roughening the surface and drilling holes through it to serve as vents and gates. Holes also are drilled for ½-inch bolts which will tie the shoe casting to the cast plastic between the shoe and the laminated die face. The casting surface is coated with epoxy resin.

(3) The mold assembly is prepared by inverting the shoe and locating the plaster cast and laminate below it with leveling jacks. The mold edges are sealed, and an epoxy casting mixture is poured through spouts attached to the plaster.

A second type of epoxy die construction is represented by the roof trim die shown in Figure 4. This die has machined steel inserts for cutting edges and wear points, with cast epoxy forming the die surface contour. The procedures for making a die of this kind are similar to those just enumerated, in that the plastic face is cast over a rough contoured cast iron punch, the surface of which is relieved about 1½ inches below the finish die surface, except at the cutting edges. The mold assembly is made with this casting inverted over a female plaster as described previously, and a similar resin mixture is poured and allowed to harden.

Dies made in this manner are very accurate dimensionally, and require virtually no finishing after removal from the mold. The low shrinkage of epoxy resin results in excellent dimensional control. Procedures similar to those just described are used in making try-out and prototype dies of all types, usually incorporating kirksite bases with epoxy skins. The use of plastic skins eliminates the extensive hand finishing otherwise required.

Plastic dies are finding increasing application in die development work. This involves determination, by making several stampings, of how many steps will be required in forming the new or changed stamping. This materially reduces the expenditures formerly needed to obtain this information, and greatly implements the start-up of production on new or proposed parts by isolating and eliminating difficulties which would otherwise cause delays and reduce efficiency.

Fig. 3. Laminated epoxy re-strike die for a rear quarter truck extension panel.

Without attempting to appraise the several methods of direct tool manufacture currently in vogue, it would appear that the most advanced stage in this field has been attained by using pressure cast, fiber glass-reinforced polyester dies for various operations. Dies made by this process undoubtedly are lowest in cost. If properly designed, they have been found capable of producing as many or more stampings as dies made by more elaborate procedures. Again, metal edges are used at wear points, and for sharp radii or cutting edges. Upwards of 100,000 good stampings have been made on cast polyester dies. In addition to their applications to volume production, they are being used for die try-out and development.

The other category of plastic tools, other than metal-working dies, is indirect or secondary tooling. By no means should it be inferred, however, that these applications are of secondary importance. In fact, in terms of volume of plastic materials used and the savings realized by automotive manufacturers or almost any other criteria, indirect tools are the more important of the two. Examples of current usages are die models, spotting racks, keller models (see Figure 5), prototypes, water test fixtures, paint spray masks, mock-ups, contour templates, assembly fixtures, checking fixtures, drill baskets, etc. The advantages that reinforced plastics have provided to the automotive industry need not be reiterated; it would be inconceivable to undertake a

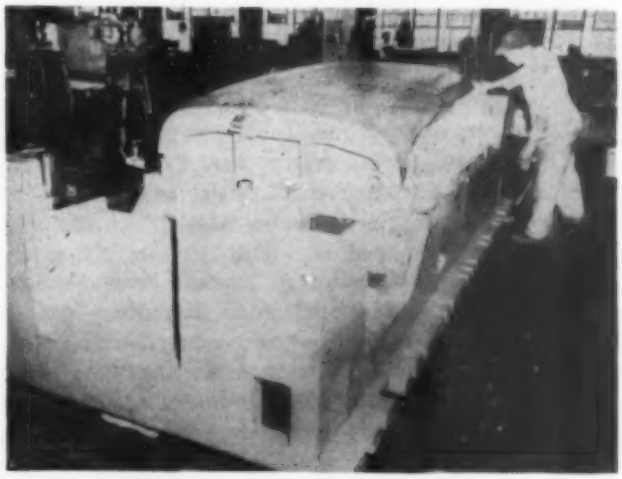


Fig. 4. Truck roof trim die of cast epoxy has steel inserts.

Fig. 5. Keller model of reinforced plastic is dimensionally stable and quickly made.

modern automotive program in terms of lead time requirements without the advances in master modeling and the tooling short-cuts which have been made possible through plastics.

To return briefly to the question posed previously: whether plastic tools for making steel parts will result in lower total cost than that involved in using steel tools for plastic parts. It will be clear that both can fill important needs if all aspects of the problem are carefully considered. It is fallacious to arbitrarily insist that one or the other alone is the sole panacea for reducing costs in low-volume production situations. Superficially, using plastic tools in making steel stampings might appear capable of producing any part at lowest total cost, regardless of volume. However, in matched die molding of reinforced plastic, one mold produces all operations and practically a finished part, while a line of operations (blank, draw, trim, etc.) usually is needed to make a corresponding steel stamping. In addition, larger and more complex parts equivalent in most cases to welded steel assemblies are made in a single mold with reinforced plastic.

The real meaning of this is that every case stands or falls on its own merits, and the lowest total cost must be determined for each part considered individually. Where the line-up to make a low-volume steel stamping involves numerous operations and, consequently, many tools, it will probably prove to be more economical to use plastic rather than steel made from the cheapest dies. Conversely, if the part is simple, it may prove cheaper to use plastic dies to make steel stampings from them. The business of manufacturing and marketing plastics, therefore, is ahead either way. The possibility still exists that a method of using plastic dies for forming plastic parts will be developed, and the plastic industry wins both ways.

An interesting and comparatively new development in this connection is the use being made of Impreg to replace mahogany for dimensionally-stable master models. This material consists of about 50% phenolic resin, and enables us to overcome some of the shortcoming of mahogany models. It has the accompanying disadvantages of high cost and poor working qualities, but offers improved resistance to swelling and warpage. The comparative stability of Impreg and mahogany is shown in Figure 6. Impreg is made by saturating mahogany veneer $\frac{1}{16}$-inch thick or less with phenolic resin, and laminating the veneers to make boards of sizes widely used in mahogany.

This brief discussion of Impreg logically leads us to the question of whether wood models of any description are needed. This is a controversial point at present. Some manufacturers still use wood models, others use plastics exclusively. Cost, of course, is the major determinant. As the familiarity of modeling shops with handling of plastics improves, the costs of master modeling with plastics will decrease. Plastic models are recognized as having inherent advantages over mahogany or even Impreg models.

Body Solder Substitutes

Various plastic substances have been suggested for production use in place of solder to obscure welded seams or to fill depressions in body panels. Lead-tin body solder has a number of fundamental deficiencies which a substitute material could substantially alleviate, including:

(1) Extensive and expensive finishing is required.

(2) Lead poisoning possibilities present a health hazard problem. The heat required to melt solder nessitates further safety precautions.

(3) A high degree of operator skill is required for quality application of body solder.

(4) Materials are costly. Waste material, while capable of being remelted, is inferior to virgin solder.

(5) Considerable plant floor space and costly solder finishing enclosures are required, as well as ample equipment lead time.

Balanced against these factors are the many inherent advantages possessed by solder, including hardness, ductibility, good adhesion to steel, and dimensional stability over wide temperature ranges. Since remelted solder is useable, waste is low if operations are properly controlled. Solder-covered surfaces are stable with paint applications.

There are nine basic requirements which a plastic substitute must fulfill in order to be considered suitable for production usage, as follows:

(1) Ease of application and finishing must be equivalent, but not necessarily similar, with those of solder.

(2) The material must not be adversely affected by temperatures ranging from —20° to + 180° F. It must be tough and resilient (fatigue and impact resistant) over this range.

(3) It must adhere strongly to steel, and permit finishing to a feather edge.

(4) Thermal expansion and shrinkage after curing

must be such that the resulting volume change will not be sufficient to outline the patch after painting and in service.

(5) It must withstand paint oven temperatures as high as 350° F.

(6) The shelf stability of the material must be good, yet it must be capable of hardening quickly at room temperature and at paint oven temperatures as low as 250° F.

(7) Shrinkage resulting from the curing reaction must be low.

(8) The material must not cause staining or other deleterious effects on body lacquers or enamels, and it must not deteriorate in any way under normal weathering conditions.

(9) It should be non-toxic, non-irritating, and not have objectionable odor.

Various substances intended to meet these requisites have been suggested and submitted to the automotive industry, including thermoplastics such as cellulose acetate butyrate, vinyl polymers, etc.: synthetic rubber compositions (the "cold solder" variety containing solvents); and epoxide-base compounds. All have some deficiencies in relation to the desired characteristics, but the modified epoxies come closet of the types mentioned to fulfilling all requirements.

At the present time, several automotive manufacturers have marketed two-part epoxy-based formulations in paste form for field service use in their dealers' repair shops. There is little question that these materials have real value, and wide-spread usage is anticipated.

Development work conducted to date on epoxy solder-replacement materials has been directed mainly toward use of bulk type paste-putty consistency formulations (filled A-stage resins) and stick type B-stage filled epoxies for application with heat. Most A-stage compounds have the disadvantage of not smoothing or troweling readily. If a torch is used to flow and cure the stick type B-stage materials, the short working life necessitates that the operator have considerable experience and dexterity. It is possible that an entirely fresh approach to the application problem should be undertaken.

To date, all plastic solder substitutes evaluated are lacking adequate impact resistance or, if this is corrected, bleeding and generally poor stability of the cured material. In light of these draw-backs, lead-tin solder currently appears to be very good, at least in terms of production usage. It is recognized, however, that the disadvantages of regular solder described above make our search for alternative materials worthwhile. Meanwhile, the plastic companies are aggressively seeking solutions to the reported difficulties. When they are found, it can be expected that the potential factory use of plastic instead of solder will resolve into a question of pure economics.

Conclusions

It is a certainty that plastic materials, especially plastics reinforced with glass fibers, have become almost vital to modern automotive model-change programs. Expanded use of reinforced-plastic panels and functional components in finished automotive products is likely and, concurrently, usage of plastic dies for forming steel will become more general. Progressive automotive companies are taking a careful look at possible plastic applications in all of these categories. We are becoming increasingly "plastic minded". The inherent advantages plastics offer will prompt us to apply them more widely as the benefits become more obvious to us through greater familiarity with the materials.

—THE END

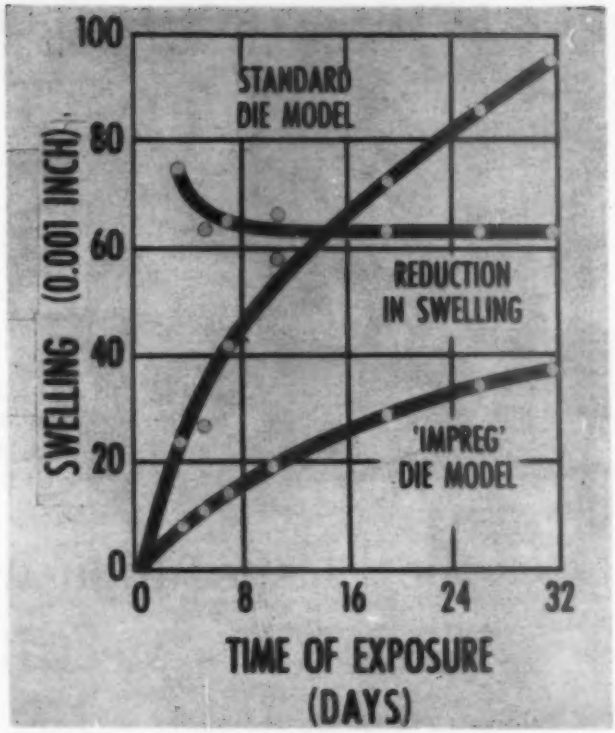


Fig. 6. Comparative swelling of Impreg and mahogany master models upon exposure at 80° F. and 90% relative humidity.

Alternate color-panels of corrugated Alsynite form a continuous decorative glazing on both the second and third floors.

Colored Alsynite Glazing

Corrugated panels of translucent Alsynite not only add to the attractiveness of commercial buildings, but perform the useful functions of light diffusion and heat blocking. Alsynite Co. of America, San Diego, Calif., manufactures the panels by combining glass mats, impregnated with polyester resins, under conditions of heat and pressure. Filtron 25, a heat-blocking agent, is added to the panels which are then Chemiglazed for surface protection.

As shown in the accompanying photograph, the panels are used in alternately colored bands which offer both eye-appeal and good structural properties. The panels can be used instead of glass in many applications such as patio roofs, skylights, office partitions, store fronts, and luminous ceilings.

—THE END

AUGUSTINE R. MARUSI
Vice President, Borden Co., and
President, Borden Chemical Division,
New York, N.Y.

Does the Plastics Industry Meet Its Responsibilities?

"SHARING Industry Responsibilities" was the title of a challenging editorial published by PLASTICS TECHNOLOGY in April-June, 1956. Mr. Arthur M. Merrill, editor of this publication, in this and subsequent dissertations has censured members of the plastics industry in rather direct terms for what he considers their flagrant and general disregard for responsibility to their products, consumers, and colleagues. The editorial remains especially provocative in review. It would seem, however, that the industry picture presented by PLASTICS TECHNOLOGY must be enlarged considerably if we are to view the implied dilemma in proper perspective. Despite the fact that the light thrown on the plastics industry by this editorial is an uncomfortable one, we should consider it a useful guide-light.

The year 1957 perhaps provides an appropriate time for a look at the plastics industry in retrospect. It is generally accepted that plastics did not come into their own until 1926—three decades ago—and that the greatest acceleration has occurred since 1946—one decade ago. This year marks the beginning of another decade in the evolution of plastics; a decade expected to launch an era of unprecedented proportions.

Editor Merrill indicates that we are not ready for the big moment. Although his premise is much too broad in scope, it is not to be argued that his declarations are entirely unwarranted. PLASTICS TECHNOLOGY, as a disseminator of information relative to its chosen field is entitled, of course, to speak out against what it considers malpractice in that field. Mr. Merrill states: ". . . Each supplier appears intent only on presenting his materials in the most favorable light; for himself, that is, not for his processor partner. The obvious inference is that the supplier wants to sell his materials, regardless of the processor's trials and tribulations. Of course, this attitude is denied vehemently by the suppliers, and the sin may be more one of omission than commission."

This is a sweeping statement indicating one and all suppliers are strangers to ethical practice. The question is: Is so all-inclusive a charge warranted? I think not. With approximately 103 firms manufacturing plastics materials, it is not unlikely that some are prone to disregard responsibility. Actually, we know of instances in which this has happened. But it is erroneous to use the known handful who have been guilty of conscious or unconscious misrepresentation as a yardstick to measure an entire segment of an industry. Since the editorial allows that some misrepresentation might have resulted from the sin of omission, let us examine that possibility.

The implication of ignorance by omission on the part of many suppliers is particularly interesting. It should be noted that most instances of materials misapplication have resulted from the simple growing pains of a large, sprawling, comparatively new industry. There are more than 5,000 firms in the over-all plastics picture today, and most of them have arrived on the scene quite recently. Although the first commercial plastic, cellulose nitrate, was developed in 1868, the very real pressures of industrial growth are contemporary. Mistakes have been made because our processes, equipment and applications had not been proved by time. Trained technical personnel has been in short supply. Consumers have not been fully oriented to the use and maintenance of plastics materials.

In spite of this, the quality of plastic materials and products has improved steadily. And the plastics production cycle is a circle, not a straight line, from materials supplier to the consumer. A general consumer demand or tentative acceptance in the economic sense must exist before the fabricator demands his plastic and the processor demands his chemicals. It is not a case, then, of manufacturers foisting off products on the consumer—the cycle is completely interrelated, a

chain with no break. This cycle has successfully repeated itself to such an extent that the Society of the Plastics Industry estimates that total 1956 production was more than four billion pounds, as compared with 2.7 billion pounds in 1954. An appreciable growth, causing appreciable pressures. The Borden Chemical Division is a very small figure in the progress march of plastics, but we, too, have been beset by numerous problems. But, like the majority of those in the business, we are eliminating them steadily.

There is the very definite possibility, when these pressures are considered, that some misapplications came about despite the fact that those in the industry were striving to provide the best possible service, Mr. Merrill states: "In the consumer products field, plastics are still trying to recover from the damaging reputation they have gained as cheap, inferior items that quickly break or fail in service. . . Too many processors were obsessed with the idea of making a quick profit on their goods, regardless of their utility in service. . ."

Certainly there have been some unscrupulous fly-by-night operators intent on a "quick kill." Also, consumers frequently have misused plastic products, disregarding manufacturer's directions and instructions. But should we not point out that plastics housewares manufacturers, for example, worked voluntarily for more than three years to effect a real code of standards?

"Both groups (suppliers and processors), however, are quick to hail the steady gains made by plastics in industrial applications. It is true that some of these successful uses were originated and developed by companies in the plastics industry. On the other hand, many others reflect the engineering abilities of the user company rather than those of the plastics industry." A true statement. American enterprise often has worked both sides of the street in this fashion. The implication here, however, would seem to minimize research done by the plastics industry, even though millions have been expended by the industry to improve its materials, services and products. A case in point is the present activity in the field of atomic bombardment of plastics. Much has been accomplished in this area already, and the plastics industry as a whole has contributed to these advances.

The editorial ends with the advocacy of closer participation between supplier and processor ". . . with neither shirking his responsibilities under the watchful eye of the user. . ."

Mr. Merrill has offered more than an excellent idea. It is an essential consideration for our swiftly-moving industry. It is to be hoped that the competitive urge never leaves American enterprise, but we in the plastics field could, perhaps, work in closer harmony in exchanging certain basic information and comparing notes. We know that other industries have profited when there has been an exchange. —THE END

Landall and Stratton Join PT Editorial Advisory Board

Alden P. Landall and E. Bowman Stratton have joined the Editorial Advisory Board of PLASTICS TECHNOLOGY as advisors in the fields of phenolic materials and vacuum forming equipment, respectively.

Mr. Landall was born in Belmont, Mass., in 1915. He attended Northeastern University, receiving a B. S. in chemical engineering in 1939. He joined General Electric Co. following his graduation, serving as product engineer—Laminated Products in 1939; development engineer—Phenolics in 1943; product engineer—Thermoplastics in 1945; materials engineer—Phenolics Products in 1947; and applications engineer—Phenolics Products in 1949. In 1954, he was appointed to his present position as supervisor of technical service engineering, Phenolic Products Sales for the Chemical Materials Department, where his duties encompass responsibilities for industrial resins and varnishes, foundry resins, molding compounds, and magnesium oxide. Mr. Landall is a member of SPE and SPI. He and his wife have two children, and reside in Pittsfield, Mass.

Alden P. Landall

E. Bowman Stratton

Mr. Stratton was born in Newton Centre, Mass., in 1909. He attended Williams College, receiving a B.A. in 1932. After being associated with the Plaskon Division of Libby-Owens-Ford Glass Co., he served with the Army Map Service from 1942-46. From 1947-51, he was chief of research and development for Industrial Radiant Heat Co. He joined Auto-Vac Co. in 1951 as technical director, and has been president of that firm since 1952. Beginning with his work for the Army Map Service and continuing through his association with Auto-Vac, he has originated much of the equipment, techniques, and production methods currently in use for the precision vacuum forming of thermoplastic sheet materials. In the course of this work, he conducted the initial forming tests on such then-new materials as Mylar, high- and low-density polyethylene, oriented styrene, high-impact styrene, the new acetates, and others. He is a member of SPE and Alpha Delta Phi. Mr. & Mrs. Stratton have two children, and live in Fairfield, Conn. —THE END

D. A. DEARLE, *Plastics Division Manager*
North & Judd Mfg. Co., New Britain, Conn.

Functional Selection of Plastic Materials—Part II

The conclusion of a two-part discussion of material selection, based on the physical properties and functions of the molded part.

Water Absorption

WITH the exception of a few thermoplastics such as polyethylene, polystyrene, and polyvinyl chloride-acetate, all the synthetic plastic materials are moisture absorptive to a certain extent. In addition to absorbing moisture when immersed in water for any length of time, plastics are affected adversely by climatic conditions. High humidities tend to change the physical properties of molded products; the change varying with each particular type of plastic composition. The effect of moisture on the mechanical characteristics of a molded part also varies with time and temperature. These two variables must be considered when attempting to evaluate or compare the moisture absorptive properties of the numerous plastics. Polyethylene excels in resistance to water absorption.

In making moisture absorption tests, it is standard practice to take a test specimen, thoroughly condition it in a drying oven, weigh it carefully, and immerse it in water. The specimen is left in the water of known temperature for a period of either 24 or 48 hours. Upon removal, the piece is weighed again. The difference in weights is observed, and the percentage of moisture absorption calculated.

In the thermosetting group of plastic materials, both cord- and fabric-filled phenolics are listed with very high water retention values. Cotton flock-filled phenolic molding compounds also are relatively high in water absorption. In most instances, moisture absorption is an undesirable characteristic, but in some applications this property is used to advantage. Fabric-filled laminates are used to make gears and bearings where water is used as a lubricant. In an application of this type, a certain amount of water absorption tends to increase the operating efficiency of the product. In the majority of cases, however, moisture absorption is detrimental to the physical properties of the material. It may cause dimensional instability, cracking, loss of soluble constituents, crazing, swelling, and, in extreme cases, gradual decomposition.

Molded ureas should not be specified in applications where lengthy exposure to moisture is expected. Cracking of the molded part may occur anywhere from six

months to one year after molding. Latent fracture, however, can usually be traced to insufficient cure, subsequent exposure to moisture, or the combination of both conditions. Items molded from urea resins are tested for optimum cure by immersing them in boiling water for a period of 15 minutes. Upon removal, if the parts appear to be chalky on the surface, it is an indication that they have not been cured for a sufficient length of time. Melamine molded parts are tested for sufficient cure by immersing samples in boiling water containing 1% sulfuric acid for a period of 10 minutes. Properly cured ureas or melamines will come out of the tests with no apparent change on the surface of the products. Large quantities of urea are used in making the component parts of many kitchen appliances, as shown in Figure 4.

In the thermoplastic group, two extremes are found in comparative hygroscopic values. The styrenes, vinyls, and polyethylene are quite water-resistant and show very low absorption when specimens are given the standard immersion tests. Consequently, these materials are considered the best in applications where moisture resistance is of prime importance. At the other end of the scale are found the cellulosics. The polyamides, too, are somewhat hygroscopic when molded.

(Photo courtesy: American Cyanamid Co.)

Fig. 4. Molded urea applications in the kitchen include radio cabinets, light-colored wire plugs, wall lampshade, and juicer housing.

Impact Strength

Impact strength may be defined very simply as the resistance an object offers to a striking force. An item falling to the floor is an example, since whether the object or the force is moving makes no difference. Large items, such as the suitcase shown in Figure 5, often are tested by dropping a heavy object on the molded part and measuring the weight times the distance of fall to determine the impact strength. This is not an accepted means of testing, but rather a special method designed for a particular end-use application.

The two standard tests for impact are the Charpy and the Izod. In the former method, a five-inch long, ½-inch square bar is placed horizontally and a blow of known magnitude is delivered to the center of the piece. In the Izod test, the specimen is held in a vertical position and a radial blow delivered.

So far as the variations in impact properties are concerned, two important factors should be kept in mind regarding the plastic materials. Firstly, the thermoplastics increase in impact strength when formulated with larger proportions of plasticizer. Secondly, the impact strength of molded thermoset compounds depends to a large extent on the fillers used. It can be seen, therefore, that impact strength can be varied by changing the plastics formulation.

Standard woodflour-filled phenolic is comparatively low in resistance to striking force, having an average value of only 0.30 foot-pound per inch of notch in the Izod test. When fillers such as those illustrated in Figure 6 are used, however, the impact strength of phenolic molding compounds can be increased tenfold. In the thermosetting group, the use of glass fibers has contributed much to increasing the impact strength of molded plastics.

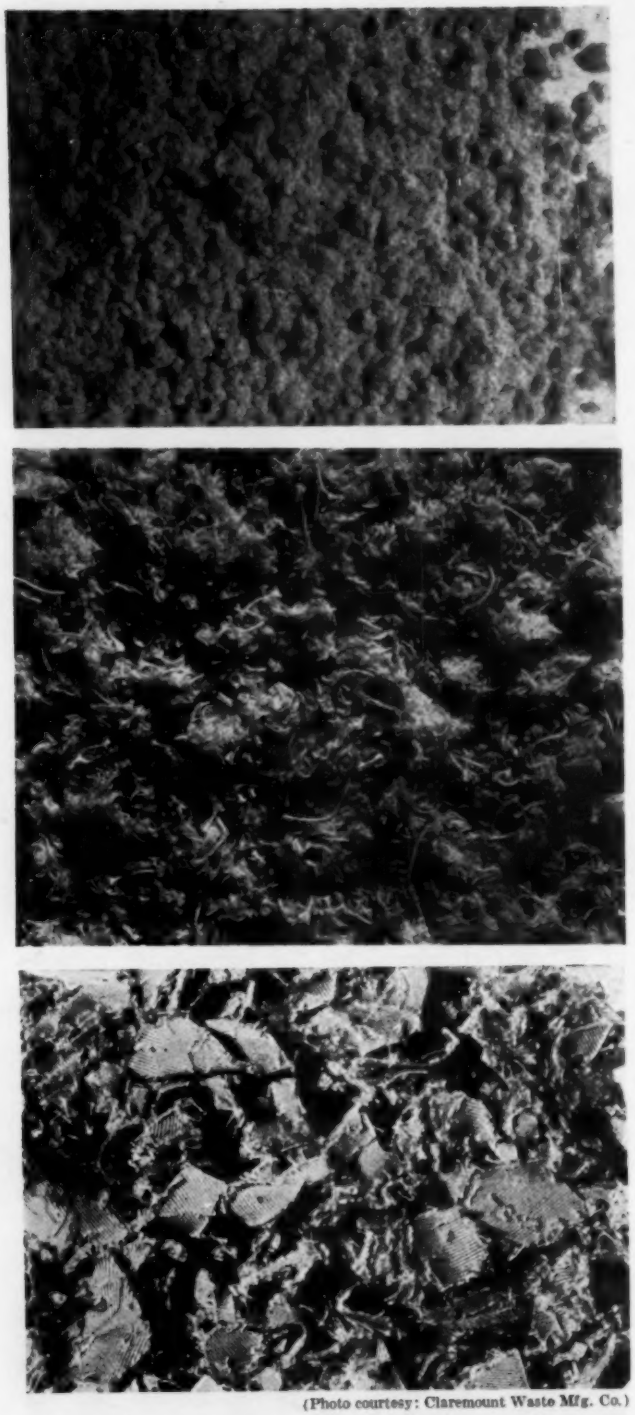
In order to obtain a phenolic material which possesses medium impact properties, cotton flock is used to replace the woodflour filler. Cord and canvas fillers are used to produce molded phenolic parts which have maximum impact strengths. These three types of filler are shown in Figure 6. In the thermoplastics, the polyamides, polyethylene, and high-shock polystyrene rate highest in impact strength, although ethyl cellulose also is excellent in this respect.

Chemical Resistance

It is incorrect, of course, to declare that plastics are resistant to all acids and alkalies. There are hundreds of different chemicals, but for comparative purposes they can be divided into four classifications. Any particular plastic material should be checked on the chart

(Photo courtesy: Owens-Corning Fiberglass Corp.)

Fig. 5. Luggage made of glass-reinforced polyester plastic has Izod impact strengths as high as 21 foot-pounds.



(Photo courtesy: Claremount Waste Mfg. Co.)

Fig. 6. Fillers to improve impact resistance of molded phenolic include (top) cotton flock, (center) cord, and (bottom) macerated canvas.

of Table 1 to see how it would be affected by strong and weak acids or strong and weak alkalies. There are no specific figures to refer to when comparing the chemical properties of plastics; instead, their general tendencies should be remembered.

On general-purpose woodflour phenolics, the effect of weak acids is practically negligible, but strong acids give a different story. Oxidizing acids decompose phenolics, but organic or reducing acids have little or no effect. On the woodflour-filled phenolics, the effect of weak alkalies varies from slight to marked, depending on the alkalinity. Strong alkalies, on the other hand, attack phenolics regardless of the filler. Soaps and detergents have no effect on phenolics, as evidenced by the washing machine agitator application which is made from an improved impact- and water-resistant composition.

All the cellulosic compounds are slightly affected by weak acids, and decomposed by strong acids. With the exception of ethyl cellulose, all the cellulosics are decomposed by strong alkalies, but are only slightly affected by the weak alkalies. The thermoplastics, in general, are soluble in certain organic solvents, especially ketones, esters, and hydrocarbons. The degree of resistance to the numerous acids, alkalies, and solvents varies with their concentrations. Polystyrene, while attacked to a certain degree, is known for its relative resistance to concentrated acids.

The polyvinyls are important materials for applications that require resistance to acids. Cellulose nitrate, as might be expected, excellently withstands the effect of nitric acid. So far as the alkalies are concerned, the same thermoplastics are found to be outstanding in their resistance. Polystyrene, ethyl cellulose, and the polyvinyls excel in resisting the strong alkalies such as caustic soda. With the exception of the polyester-glass fiber materials, practically all molded plastics withstand the effects of the weaker alkalies.

There are innumerable organic solvents which are of interest for two reasons: (1) they are used to advantage with the thermoplastics in forming cements and finishing compounds; and (2) most of the thermosetting compounds are unaffected by organic solvents. The phenolics, for instance, are alcohol-proof. Hence, thermoset laminates are often specified for trays, cocktail bars, and similar applications where alcoholic beverages are encountered. In the thermoplastics, polyvinylidene chloride excels in resistance to solvents, while polyvinyl chloride-acetate and polystyrene are outstanding in resistance to alcohols.

Sunlight Exposure

Ultra-violet rays produce chemical changes on many plastic materials and molded items. The phenolics, when molded in colors, will gradually darken with continuous exposure to light. Clear, transparent cellulose nitrate also will tend to become an amber shade after very long sunlight exposure. The ureas and melamines are unaffected by sunlight and, hence should be specified when permanence in the pastel shades is desired. Millions of buttons, buckles, and cosmetic containers are molded each year from the ureas and melamines.

The most light-stable thermoplastic is polymethyl methacrylate, the material used for aircraft canopies. In addition, the acrylics are used for applications where their property of 'bending light' can be used to advantage.

Tensile Strength

Tensile strength is defined as the pulling force necessary to break an item, expressed in force per unit area. Dumb-bell type specimens used for standard tensile tests are approximately nine inches long, ¾ inch wide at the ends, and about ½ inch along the center section. Thicknesses of the test specimens vary from ⅛-

inch for molded parts up to one half inch for sheet stock. As shown in Figure 7, the piece to be tested is held between jaws and tension is applied by a pulling action at a predetermined rate.

Plastics, in general, possess relatively low tensile strength values. Whereas steels run up into the tens of thousands of psi.'s, the molded plastic materials, both thermoplastic and thermoset, average 2,000-10,000 psi. There are some exceptions in the non-molded group, such as the polyamide fibers where strength as high as 50,000 psi. are obtained. Styrene-acrylonitrile plastic is another exception. This material exhibits an unusually high average tensile value of 11,000 psi. The average tensile values of woodflour-filled phenolics range between 7,000-8,000 psi., and neither the ureas nor the melamines excel in tensile properties. In the thermoplastic group, the acrylonitriles and the polyamides are the best.

Before leaving the discussion of tensile strength, mention should be made of the relationship that exists between the various physical properties of molded plastics. For example, the addition of more plasticizer gives thermoplastic higher impact strengths, but reduces their tensile strengths. Some advantages may be gained in one particular property at the expense of another. Many other factors influence the physical strength of molded parts, including design, molding conditions, and service conditions.

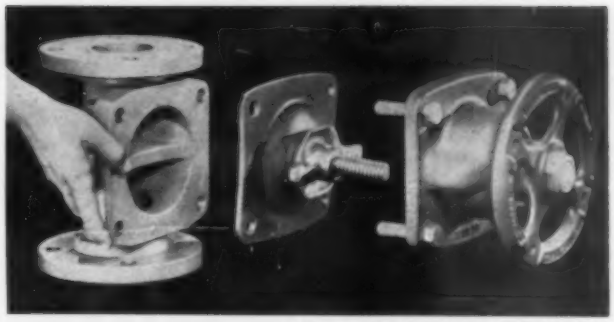
Compressive Strength

On the average, compressive strength values of molded plastics run anywhere from three to five times higher than their tensile strengths. In the thermosetting group, melamines and ureas excel in compressive strength, while cellulose nitrate and cellulose acetate head the list of the thermoplastics.

In making standard compression tests on plastic molded parts, cylindrical shaped specimens are used. These are approximately one-inch in diameter and about ¼-inch thick. Uniform compressive pressure is applied gradually, and the number of pounds recorded when fracture occurs. The actual compressive strength is calculated by dividing the number of pounds required to break the part by the surface area of the specimen.

(Photo courtesy: Ferro Corp.)

Fig. 7. Tensile testing a specimen of molded plastic laminate.



(Photo courtesy: United States Rubber Co.)

Fig. 8. Three-inch diameter molded valve body (left) is made of styrene-acrylonitrile plastic.

Flexural Strength

A splendid illustration of flexural or transverse strength is to be found in the ordinary bow used in archery which is flexed so that the ends are pulled backward while the middle of the bow is pushed forward. This arrangement exemplifies transverse forces, and the resistance offered by the willowy bow is a measure of its flexural strength. Stated technically, transverse or flexural strength relates to the ability of a beam supported at both ends to withstand failure when a load is applied at the center.

In addition to knowing the cross-section of the specimen to be tested, the distance between the supports also must be taken into consideration. It is quite evident that the amount of deflection at the center of the piece will increase as the supporting forces are placed farther apart. Flexural strength is expressed in pounds per square inch and, in view of the number of variables involved, must be computed by formulas that include cross-sectional dimensions.

Before the polyester-glass fiber compounds were introduced, melamines led the field of thermoset molded compounds in flexural strength. Now, however, products molded out of polyester-glass fiber are the strongest of all the most common plastics, even surpassing the best of the thermoplastics. In the latter group, both the acrylics and the acrylonitriles are the leaders in flexural strength properties. The valve body illustrated in Figure 8 is made from acrylonitrile resins. Although acetobutyrate appears to be the poorest in flexural strength, this inferior property is offset to a large extent by its excellent impact strength.

Hardness

It is generally recognized that plastic molded materials possess comparatively soft surfaces, and react to surface abrasion more like soft wood or brass. They are restricted, therefore, to applications where rough surface treatment is not expected. Resistance to surface scratching is only one of the three measures of hardness. Tests for scratch resistance of a material do not necessarily determine the actual hardness of the entire specimen. The surface of a plastic molded item is usually smooth and glossy, but the layers under the surface very often are different in both texture and physical properties. Hence, scratch and surface abrasion tests must be considered as separate and apart from the penetration hardness test.

To determine the actual scratch resistance of a material, the standard procedure is to draw a pointed diamond of known load across the surface of the specimen. This action produces a groove which is subsequently measured for depth and width. Microscopic comparison of the results is used as a basis for the resistance of the sample to surface scratching. For flat surface abrasion tests, rough discs are rotated against the specimens. Comparison of specimen weight before and after application is used to determine the abrasion resistance.

A more representative test of hardness is to be found in the ball penetration method. In this determination of hardness, a small ball is pressed under a known load into the test specimen, and the result measured in the form of a weight:depth ratio.

The rigid vinyls are among the best materials for resistance to abrasion and, hence, are used extensively for phonograph records. For indentation hardness, the ureas and melamines head the list in Table 1. Either one of these thermosetting materials should be specified in applications where the greatest degree of hardness is required in the finished product.

Due to the elastomeric characteristics of some of the thermoplastics, it is sometimes difficult to obtain accurate ball penetration tests. Further difficulty is encountered because of the tendency of the thermoplastics to creep and cold flow after molding. As a result, the hardness of elastomeric plastic materials is measured by a Durometer which uses a small point instead of a ball, and measures the depth of penetration.

Modulus of Elasticity

The measurement of elasticity is related to several of the other properties previously discussed where the forces applied during testing tend to distort or stretch the specimens. The stretch or deflection increases as the load is increased but, up to a certain point, the specimen will return to its original dimensions after removal of the load. If the load becomes so great that the test piece will no longer return to its original form, then the specimen material is said to have reached its elastic limit. From a zero load up to the elastic limit, there often occurs a stretch or deflection rate which is proportional to the loading rate. The ratio of load to deflection is the modulus of elasticity of the material.

As can be seen, a material's modulus of elasticity is a measurement of its rigidity. Thus, polyethylene and the vinyl elastomers possess quite low moduli. The stress: strain ratio varies considerably among the molded plastic materials. As might be expected, the thermosets are far superior to the thermoplastics in moduli values. Compared with metals, the molded plastics fall far short for structural applications. On a weight-for-weight basis, however, this wide discrepancy narrows down considerably.

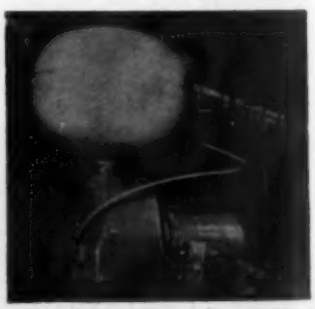
Conclusions

As previously noted, the large family of plastic materials continues to grow from day to day. This expansion is the result of the constant research and development work by chemical engineers and plastics technicians. In the thermoset plastics line, most of the recent improvements have been in the direction of gaining higher impact properties. Glass fiber fillers have contributed largely toward this end.

The inorganic has been teamed up with the organic to produce modern materials of far greater utility. Much progress also has been made from intensification of copolymerization of many of the thermoplastics. Undoubtedly, the future will see further development along these lines. Whether in the thermoset or the thermoplastics materials, it is safe to say that forthcoming molded plastic parts will have even greater strength: weight ratios than those which exist today.

—The End

Polyamide Pressure-Switch Tubing



Polyamide tubing connects pump case and pressure switch on horizontal ejector.

Corrosion-resistant polyamide tubing, supplied by Polymer Corp. of Pennsylvania, Reading, Pa., has replaced the copper tubing formerly used by Fairbanks-Morse & Co., St. Louis, Mo., to connect the pump case and pressure switch on its ¼-1 hp. horizontal ejector. The tubing, trademarked Nylaflow, requires no deburring or prebending, thus permitting savings of 55-60% in materials and labor.

Nylaflow tubing is cut to length with a sharp knife and installed with standard metal compression fittings. Used as air lines under pressures of 17-40 psi., the tubing takes a perfectly symmetrical bend between connections. Fairbanks-Morse reported the tubing, with a short-time burst rating of 1,000 psi., to be less in original cost than the copper. Nylaflow tubing was supplied in 3/16- and ¼-inch O.D. sizes.

The copper tubing had to be cut to length on a power saw, deburred internally and externally with a cone-shaped milling cutter, and pre-bent by hand at the assembly bench for final installation. These extra handling operations were not only time-consuming and costly, but also involved substantial maintenance of the cut-off and deburring equipment.

—The End

J. H. Beno

E. F. Smith

A. M. Dowell

Load-Deflection Properties of Glass-Reinforced Plastic Laminates Under Rapid Heating

Test results indicate that plastic deformation of laminates may be eliminated by either a flashcure or a suitable postcure.

J. H. BENO, E. F. SMITH, *and* A. M. DOWELL,
Members of the Technical Staff,
Plastics Dept., Research Laboratories,
Hughes Aircraft Co., Culver City, Calif.

STRUCTURAL components for use in applications subjected simultaneously to large loads and rapidly increasing temperatures are being manufactured of thin fiberglass-phenolic laminates. Examples of such applications are laminates for aerodynamic surfaces on guided missiles, and as structural components in high-speed aircraft.

Although the laminates that were tested after 30 minutes of exposure at elevated temperatures equivalent to the maximum temperatures expected in flight possessed adequate physical properties, it was not known how similar laminates would behave when subjected to high loads and rapid heating. Because the standard test procedures did not adequately simulate the required aerodynamic conditions, it was necessary to devise a test that did. The test used involved a study of the deflection of a beam while it was subjected to a rapid increase in temperature and a constant load.

Results of tests by this method show that a fiberglass-phenolic laminate will exhibit plastic deformation loaded and suddenly heated to a temperature greater than that at which it was postcured. Although this deformation is of short duration, the deflection that occurs in the laminate could defeat the purpose for which the part was intended.

Test Program

For this exploratory program, three-ply laminates

were made of E.C.C. 181-114 glass cloth pre-impregnated with a temperature-resistant, low-pressure phenolic laminating resin. Iron-Constantan thermocouples were embedded in some of the laminates to measure the laminate temperatures during test. The molding parameters were chosen to give laminates with both high and low resin contents.

The laminates of high resin content were made by subjecting a cellophane-wrapped layup to a pre-squeeze time of two minutes at 135° C., and then applying a platen pressure of 125 psi. for 13 minutes. The laminates of low resin content were made by subjecting a cellophane-wrapped layup to a pre-squeeze time of 30 seconds at 149° C., and then using sufficient pressure to close down to 0.030-inch stops. All laminates were then given a preliminary postcure of 17 hours at 132° C. in a forced-draft oven.

Final postcure followed one of three cycles; air, nitrogen, or silicone oil. The air postcure consisted of one hour each at 149, 177, and 204° C. The nitrogen postcure consisted of continuously flushing the oven with dry nitrogen for ½-hour at 21-132° C., and then for ¾-hour each at 132, 160, 188, 216, 244, 271, 299, and 327° C. The oven was cooled to 93° C. for 1½ hours before the laminates were removed.

The silicone oil postcure consisted of placing the laminates in a beaker of DC 200 Fluid (500 centistokes viscosity) and heating from room temperature to 132° C. in 1½ hours. Then, the postcure cycle consisted of ½-hour each at 132, 160, 188, 216, 244, 271, 299, and 327° C. The laminates were cooled to room temperature before being removed from the oil.

Volatiles were determined by the difference in weight of pre-impregnated cloth samples before and after heating for 30 minutes at 204° C. Resin contents of the sample also were calculated. The flexural strengths of specimens both with and without flash cures were measured by means of a Dillon Dynamometer Testing Machine having a crosshead rate of 0.040-inch per minute.

Certain samples were flash cured in a muffle furnace in which the temperature of the test sample was raised to 280° C. in 20-25 seconds, then quickly raised to 320-350° C. at which it was held until the total elapsed time was 40 or 120 seconds. For the flash cure, specimens were mounted on the stand shown in Figure 1. One specimen containing a thermocouple was included during each flash-cure cycle, and the rise in temperature was measured by means of this embedded thermocouple and a potentiometer. The specimens were staggered in position to minimize heat stagnation within the muffle furnace chamber.

Test specimens measuring one by three inches were cut from the laminates and treated for resin analysis, flexural strength at room temperature, and effect of temperature on load deflection.

The resin analysis consisted of a test for volatiles, and tests for resin contents of specimens that were postcured, given 40 seconds of flash cure, or given 120 seconds of flash cure. The tests for flexural strength at room temperature and load-deflection at various temperatures were conducted on three types of specimens; postcured, flash cured for 40 seconds, and flash cured for 120 seconds.

The equipment illustrated in Figure 2 was used to obtain data for plotting load-deflection curves. This

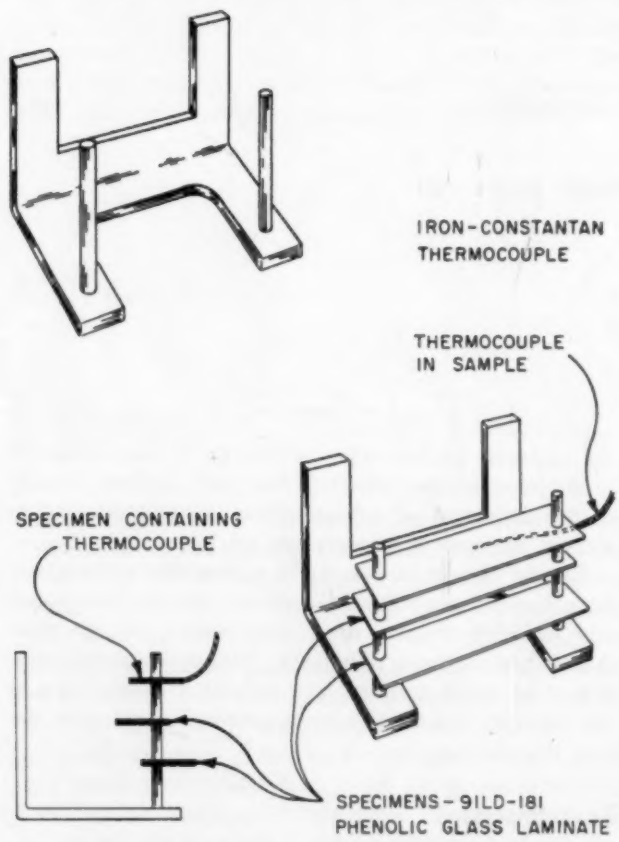


Fig. 1. Specimen holder for flash cure tests.

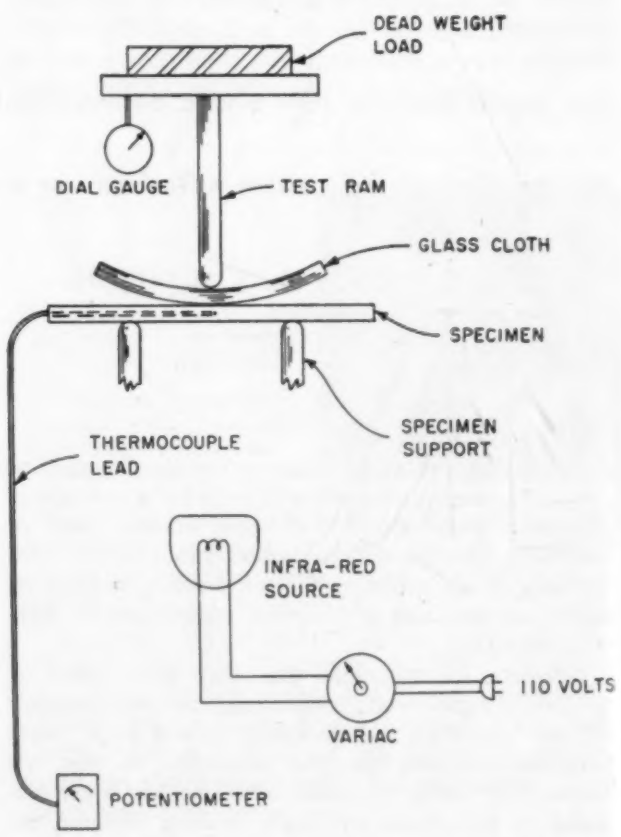


Fig. 2. Set-up for load deflection tests.

Table 1. Flexural Strengths and Resin Contents of Test Laminates (Volatile Material, 5.63%).

Flash Cure, Seconds	High Resin Content Laminate		Low Resin Content Laminate	
	Flexural Strength, Psi.	Resin Content, %	Flexural Strength, Psi.	Resin Content, %
0	53,300	36.6	66,300	28.8
40	40,100	36.2	46,900	28.2
120	42,900	36.0	42,700	28.0

equipment consists of a heat source, a specimen holder, a load applicator, a dial gauge, and a potentiometer. The heat source, a 1,000-watt infra-red lamp mounted in a focusing reflector having a focal length of 1¾ inches, was controlled by a Variac. The specimen was held over the lamp on steel supports having a one-inch span length. Three layers of non-impregnated 120 glass cloth are placed on top of the specimen as insulation, and the load applicator rested on these. The dial gauge was mounted so as to measure the amount of movement of the load applicator platform, thereby indicating the deflection occurring in the specimen. The potentiometer was used with the embedded thermocouple to determine the temperature at the center.

The rate of heating of the specimen first was established. This was done by placing a one by three-inch sample with an embedded thermocouple in the position of the test specimen and at the focal point of the heat source. The specimen's "room temperature" was noted, the infra-red lamp was turned on with a pre-set voltage input, and temperatures were recorded periodically for two minutes. Data for a series of heating curves were obtained in this manner, and for a given voltage input the heating curves could be adequately duplicated. This heat source gave a temperature rise from 24-350° C. in two minutes. By checking the temperature rise throughout the experiments, a family of curves was obtained and is shown in Figure 3.

A specimen was then placed in the test set-up, a load was applied to give a pre-determined stress, and the initial deflection was read on the dial gauge. The heat source was then applied and deflections were read periodically from the dial gauge for the duration of the test. In this manner, the curves shown in Figure 3 were obtained.

Test Results

Panels were compared for resin content, flexural strength at room temperature, and deflection under heating. The flexural strengths of laminates having high low resin contents are given in Table 1 for three conditions of flash cure. This table also shows the actual resin contents of the laminates tested.

From these results, it is apparent that flash cure affects the flexural strengths of high-resin content laminates less than it does that of laminates having low resin content. There is no statistically significant difference between the flexural strengths of laminates subjected to a 40-second flash cure and those of laminates subjected to a 120-second flash cure, regardless of resin content.

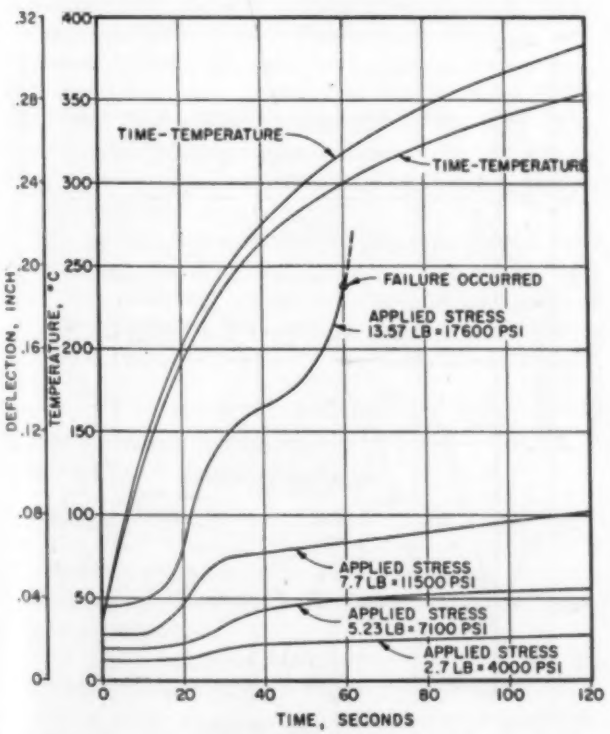


Fig. 3. Temperature-load deflection curves for high resin content fiberglass-phenolic laminate with no flashcure.

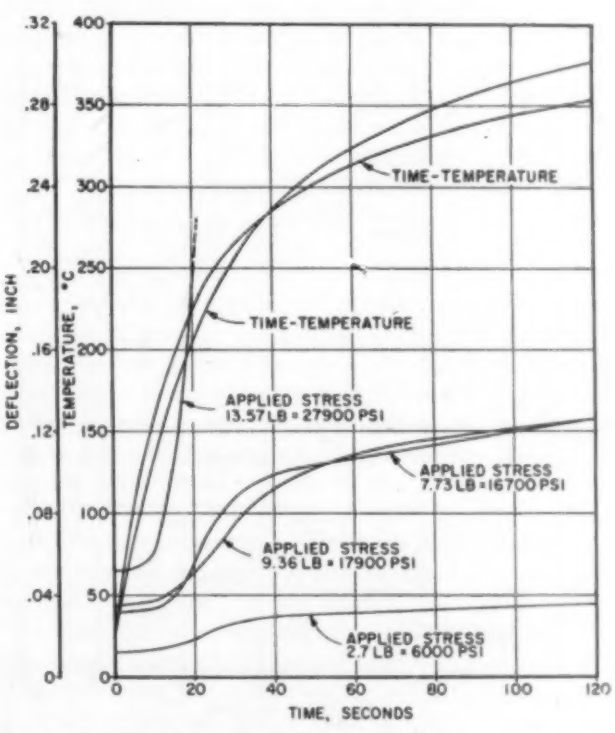

DEFLECTION, INCH
TEMPERATURE, °C
TIME, SECONDS
TIME-TEMPERATURE
TIME-TEMPERATURE
APPLIED STRESS 13.57 LB = 27900 PSI
APPLIED STRESS 7.73 LB = 16700 PSI
APPLIED STRESS 9.36 LB = 17900 PSI
APPLIED STRESS 2.7 LB = 6000 PSI

Fig. 4. Temperature-load deflection curves for low resin content fiberglass-phenolic laminate with no flashcure.

Deflection tests were then run on laminates that had been postcured in air at 204° C. When the results of these tests were plotted (see Figures 3 and 4), it was found that during the period from 20-40 seconds of heating, which corresponds to temperatures of 200-260° C., large deflections occurred in the samples. As time and temperature increased, the curves flattened out and the deflection increased slowly. This was interpreted to mean that thermosetting resins heated rapidly to temperatures exceeding their postcure temperature exhibit plastic deformation for a short time.

During this period of plasticity, postforming will occur if loads are applied to the laminate. A comparison of Figures 3 and 4 shows that the laminates of high resin content exhibit less postforming than those of low resin content. To determine if this was a phenomenon of laminates in general, other thermosetting laminates (a commercial melamine-glass laminate and an epoxy-modified phenolic-glass laminate) were tested. These results are shown in Figure 5. It was concluded from these tests that plastic deformation may be characteristic of thermosetting laminates.

Because of this assumption, it was important to find a means of eliminating plastic deformation. From a consideration of the properties of the material and the shapes of the curves shown in Figures 3-5, it was thought that a flash cure similar to the heating used during the test would eliminate or at least minimize plastic deformation. A new set of laminates was used to investigate the effect of flash cure on deformation. Enough samples were used to determine the load-deformation curves shown in Figure 6 for three conditions; no flash cure, 40 seconds of flash cure, and 120 seconds of flash cure.

From a study of these curves, it was decided that a flash cure would definitely decrease the plastic deformation of the laminate. However, it was not thought that an extended flash cure offered any advantages over a short flash cure; it is the temperature that is reached in a few seconds which is the important factor.

Since a flash cure often is uneven in application, a better technique was required. Instead of a flash cure, therefore, postcure at a higher temperature was tried in order to eliminate the plastic deformation of the laminate. Laminates were postcured by one of the following methods:

(1) To 232° C. in a forced-draft oven.
(2) To 327° C. in a non-oxidizing atmosphere (dry nitrogen).
(3) To 327° C. in a non-oxidizing fluid (silicone oil).

Samples were subjected to the load-deformation tests as before, and the test results are shown in Figure 7. The curves show that plastic deformation is eliminated when higher postcure temperatures are employed. They also indicate that a postcure in a non-oxidizing fluid is preferable to a postcure in a non-oxidizing atmosphere.

A comparison of the curve for air postcure in Figure 7 with the curve for an applied stress of 11,500 psi. in Figure 3 shows that the higher postcure used in the former results in less deformation than the lower postcure used in the latter (50 mils versus 60 mils with a temperature difference of 27½° C. in postcure, and with temperature increases in the ranges of 115-290° C. and 175-235° C.).

Summary and Conclusions

It was observed that thermosetting resin laminates, such as phenolic-fiberglass laminates, ordinarily exhibit plastic deformation, or postforming behavior, when simultaneously subjected to loading and rapid heating. This postforming may be serious in many applications;

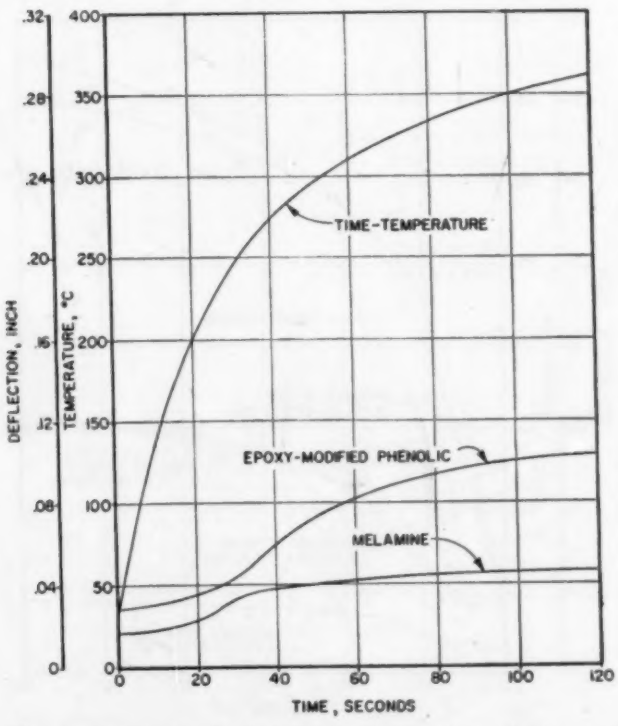


Fig. 5. Temperature-load deflection curves for melamine and epoxy-modified phenolic laminates.

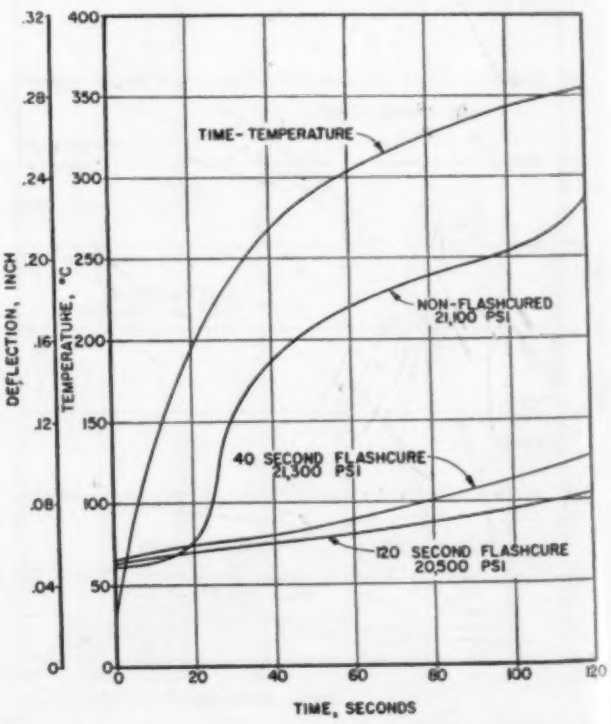


Fig. 6. Effect of flashcure time on load deformation.

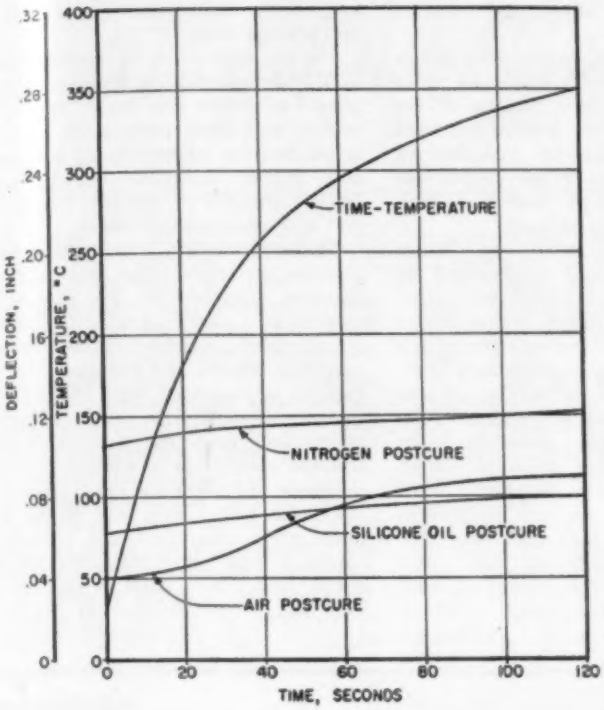


Fig. 7. Effect of postcure type on time-deflection temperature properties of fiberglass-phenolic laminates.

for example, in laminates that are structural members of an aircraft. A simple and useful technique for studying this phenomenon has been presented.

This study showed that a phenolic-fiberglass laminate, when simultaneously subjected to loading and rapid temperature rise, exhibits a plastic deformation at temperatures at or above those of postcure. Plastic deformation occurs during a short period of time in the heating cycle. Since the rate of heating is very rapid, however, the temperature range covered during this short period can be as much as 175° C.

Plastic deformation may be eliminated either by a flash cure, or by a postcure at temperatures higher than those that will be encountered by the part during service. Plastic deformation occurred in all of the thermosetting resin laminates that were not postcured as described above.

Because the materials used in this investigation were restricted to thin phenolic fiberglass, it is highly desirable that additional information be obtained on thick phenolic laminates, as well as on other reinforced plastics materials.

—The End

Design for Better Calendering
(*Continued from page 190*)

importance in designing a calender for the production of modern materials. These features, such as drilled rolls, circulating-liquid temperature-control systems for rolls, and two-speed motorized roll adjustments have become standard equipment.

This paper has been intended to emphasize the important calender design features that should be considered in order to minimize obsolescence of machinery in this rapidly-growing industry.

—The End

Dylite being used as pipe insulation at Idlewild Airport.

Foamed Polystyrene Pipe Insulation

The first major use of polystyrene foam as pipe insulation is currently underway at the New York International ("Idlewild") Airport. Scheduled for summer completion, the installation consists primarily of underground pipe insulation for cold water lines supplying the Airport's new air-conditioning system. Over 20,000 linear feet of the foam will be employed.

The insulation is being molded and applied by Mundet Cork Corp., North Bergen, N. J. Dylite expandable polystyrene, a recent development of Koppers Co., Inc., was selected for the job after extensive testing of various insulating materials. In addition to supplying effective insulation, the material features ease of fabrication, good compressive strength/weight and low water absorption.

Dylite was foamed in a mold to the exact size and shape desired. The semicylindrical sections then were applied around the exterior of the wrapped pipe in pairs, and "mopped-in" with a coating compound. Each pair of sections are wired around the outside circumference. When completed, the outer surface is sealed with another "mopping" of the coating compound.

Almost the entire network of piping will be under water for six months out of every year. For this reason, it was vital that the insulation be virtually waterproof. Fabricaton techniques are obviated by the material's ability to be molded to shape.

—The End

PLASTICS TECHNOLOGY ENGINEERING FORUM

Reinforced Plastics

Edited by:
HARRY T. DOUGLAS
Executive Vice President,
Lunn Laminates, Inc.,
Huntington Station, N. Y.

Usually in the early part of the year, many predictions are expounded by executives from varied industries. In the reinforced plastics field we have read such forecasts, too, sometimes with great expectations of technical achievements supposedly just around the corner, and later discovered that these anticipated wonders had fizzled.

Therefore, instead of saying how promising the future will be, let's be more practical and recap how successful the past year has been. This is what has been accomplished in a relatively new field of plastics. The polyester resin output for 1956 topped 71.8-million pounds, a gain of 30% over the previous year.

In the military field, reinforced plastics expanded into additional applications of this highly suitable material for submarine fairwaters, 36-foot landing crafts, better radomes to house sensitive equipment, airplane components, communications aids, large domes to enclose military equipment and personnel in the severe weather of the Arctic, sleds, skis, rifles, protective body shields, and many other products where the factors of corrosion, durability, light weight, and performance are important.

Industry saw new uses last year for chemically-resistant reinforced plastic piping possessing excellent dielectric strength in its applications for electronics, antennas and electrical cable conduits. Construction and utilities industries adopted it for water and sewage lines.

Further expansion of reinforced plastics in the automobile line found cabs, interior panels of buses and trailer trucks, truck bodies, and other parts made of this material because of savings in maintenance, easy repair, durability, better insulation against changes in weather, lower weight, and less vibration and noise.

Shatterproof and translucent reinforced plastics materials offer improved safety features, diffused light, and reduced glare, as well as a choice of colors for skylights, patios, covers, stairway railings, decorative paneling, fences, and partitions. These expanding applications were spurred by successful uses during the previous year where in outdoor tests the material withstood climatic conditions to warrant enthusiastic renewals of orders for the following year.

On the fabric side, one of the leading fiber glass manufacturers announced a "Form Fitting" fiber glass mat which produced better boat hulls in one operation. The mat is the heaviest in the industry

(*Continued on page 210*)

Compression and Transfer Molding

Edited by:
JOHN H. WOODRUFF,
President,
Auburn Button Works, Inc., Auburn, N.Y.

The thermosetting molding industry is continuing at about the same pace as during the past six years. Thermosetting molding material sales, during this period, have risen only from 270,000,000 pounds in 1951, to 290,000,000 for 1955 and an estimated 280-290,000,000 for 1956. This is an increase of only 7%, which is less than the population increase. During this same period, thermoplastic molding material sales have risen from 520,000,000 pounds to 1,200,000,000 or an increase of 130%. While this picture does not provide a great deal of comfort to the compression molder, the situation actually is worse than pictured for the average custom compression molder since a large part of the 10-20 million pound growth has been in melamine tableware, and phenolic material sales have shown a decrease of about 10,000,000 pounds.

What can the compression molding industry do to further the growth and prosperity of their business? We all see frequent conversions of thermosetting parts to thermoplastic, and this trend seems to be increasing as the thermoplastic material suppliers improve the physical properties of their materials. A frequent answer to this difficult question is creative selling and the development of new markets for thermosets. However, this approach has not been too successful. One material supplier spent several years and many dollars searching for a new market and gave birth only to the compression-molded phenolic furniture drawer. While a few molds are currently operating, these drawers have not turned out to be a significant material

user, and the thermoplastic materials, in many applications, are again less expensive and equally satisfactory. Another material supplier concentrated for some time on developing phenolic applications in the fantastically large textile industry, but again without much success.

Compression and transfer molding are generally slower than injection, and the resulting higher molding cost must be offset by faster cycles, cheaper materials,

(*Continued on page 210*)

Mold Making and Tooling

Edited by:
ERNEST J. CSASZAR,
Vice President,
Eagle Tool & Machine Co., Hillside, N.J.

Today's molding applications are pointing out a growing trend towards automation. Developments in molding presses and materials, as well as advances in molding techniques, have brought us closer and closer to the fully-automatic molding cycle. In order to properly design and construct molds to produce effectively, the moldmake must keep infomed on these developments.

Let us take as an example a high-production thermoplastic molding application involving polyethylene as the molding compound. First, the mold must be designed and constructed to fit the press selected for the molding. If automation is involved, the mold must contain features to accommodate the special press actions. Mold opening sequences must be timed to act properly within the press stroke limits. Auxiliary actions, if any, also must be considered here to suit the press features.

Second, the mold must accommodate the material to be molded. Polyethylene, perhaps more particularly than many other molding compounds, reacts rather markedly to molding conditions. Its shrinkages and ultimate dimensions are greatly affected by cyclic conditions; therefore, if critical dimensions are to be held, the moldmaker must carefully consider the cycle factors that will affect the final dimensions. Special considerations may be involved concerning cooling lines, runner systems, gating, or other factors that are peculiar to the material being molded.

Third, the mold must contain features to accommodate the application of a particlar molder's molding technique. After a press, molding compound, and a mold are gathered together, there still remains another phase to complete a molding venture. To these elements, the molder applies a cycle of operations, employing certain skills and knowledge in order to produce satisfactory moldings. The mold, then, must be so designed and constructed,

(*Continued on page 210*)

News of the Societies

Forms Cellular Plastics Group

To fill the important need for cellular plastics standards, the American Society for Testing Materials, Committee D-20 on Plastics, has organized Subcommittee XX on Cellular Plastics. I. T. Stoneback, Federal Telecommunications Laboratories, is chairman of the group, and Betty Lou Raskin, Johns Hopkins University Radiation Laboratory, is secretary.

The Subcommittee has organized a section to develop test methods, and other sections to work on specifications for polyurethane, PVC, polystyrene, and polyethylene cellular plastics. Anyone interested in participating in the work of the group is invited to contact Mr. Stoneback at the Federal laboratories in Nutley, N. J.

SPE St. Louis Section

The new officers of the SPE St. Louis Section for 1957 are as follows: president, Harold Holz, Bakelite Co.; vice president, Parke Woodworth, E. I. du Pont de Nemours & Co., Inc.; secretary, James Sharbaugh, Allied Industries, Inc.; and treasurer, Robert McDorman, Plastics Supply Co. The newly-elected directors are Otto Wulfert, Wagner Electric Co.; Richard Baumgartner, Allied Chemical & Dye Corp.; and Mr. Woodworth.

SPE Newark-New York Sections

A panel discussion on the maintenance of the hydraulic molding machine featured the joint dinner meeting of the SPE Newark and New York Sections on January 9 at the Military Park Hotel, Newark, N. J. A total attendance of 175 members and guests of the two Sections was present at the meeting, the first of the year for both groups. W. W. Gryce, Louis Marx & Co., Inc., was moderator of the discussion, and the panel members were J. G. Thompson, chief engineer of the injection molding machine division, Lombard Governor Corp.; F. R. Cinco, electrical engineer, Reed-Prentice Corp.; C. C. Bonnell, assistant service manager, Vickers, Inc.; and R. O. Sharpe, senior engineering representative, Socony Mobil Oil Co.

In his talk, Mr. Thompson drew an analogy to aircraft maintenance, in that hydraulic molding machine maintenance should include planned inspections, daily operating inspections, appraisal of information, and maintenance of records. Preventive maintenance guards against main breakdown, and enables choosing the time to perform maintenance work indicated by evaluation of records kept.

Mr. Cinco stressed the importance of proper maintenance of electrical equipment. The effectiveness of any such program is reflected by reductions in the number and frequency of shut-downs for emergency repairs. An important phase of this maintenance is identification and evaluation of critical items and the provision of necessary replacements for such components. The outstanding deterrents to proper functioning and long life of electrical equipment are dirt, dust, chemicals, improper lubrication, and vibration.

Mr. Bonnell noted that pressure, temperature, oil condition, and noise are important in maintaining hydraulic systems. Vickers has a service school to train hydraulic maintenance technicians, and the speaker invited everyone in the audience to investigate this program. Superior maintenance requires selected men trained to analyze and correct troubles, and check circuit prints before dismantling.

Mr. Sharpe discussed the essential characteristics of hydraulic fluids, including effect and function of viscosity, oxidation stability, film strength, rust prevention, and demulsability. Flame-resistant materials also were described briefly.

Many questions were raised by the audience following the panel talks, with most emphasis being placed on the flame-resistant hydraulic fluids. The meeting concluded with a drawing for door prizes contributed by plastics suppliers.

Reinforced Group, SPE New York

The Reinforced Plastics Group of SPE's New York Section met on January 30 at Tufaro's Restaurant, Corona, L. I., N. Y. Jerome D. Bassin, Borden Co., addressed the 45 members and guests on "New Epoxy Resins." An abstract of his talk follows:

Epoxies have been available commercially only for about five years. They include four basic types: the Bis-Phenol-A resins, which account for about 95% of the commercially available epoxy resins; Novolac epoxies, which can be cross-linked to give resins of higher stability and strength; Glycerine epoxies, which have a very low viscosity but little heat and water resistance; and the Peroxide epoxies, which are expected to be the least costly.

Mr. Bassin also covered converters for epoxy resins, and accelerators for epoxy-converter systems. The former includes both room temperature and elevated temperature materials, and the latter includes anhydrides and amines. Resin specifications were considered in some detail.

The Reinforced Plastics Group of SPE's New York Section held its February 27 meeting at Tufaro's Restaurant, Corona, L. I., N. Y., with 50 members and guests attending. S. H. A. Young, Pressurform Container Corp., spoke on "Pressurform—A New High-Speed Molding Process," which permits the economical mass production of reinforced plastic parts. It is said to permit variable thicknesses in the design of major parts, provide a high degree of part uniformity, permit high-speed production of preforms, and provide mechanization of the entire preform process.

Essentially, the Pressurform process is similar to pulp molding. Water and reinforcing fiber are fed into a tank, agitated to form a slurry, metered into the mold cavity of a preforming press, and compressed at pressures of 50-200 psi. The ejected preform is dried in an oven for approximately 55 seconds, and weight deviations are reported to be no more than 2%. Tooling is costly, but the process is intended for mass production and actual costs are considerably under those for matched metal molds.

"Flowform Molding of Reinforced Plastics" was covered by William F. Turner, Reichhold Chemicals, Inc. In use for many years, the process consists of laying up reinforcing mats or cloth in the female mold, pouring a predetermined quantity of resin onto the mats, and inserting a male plug to the desired depth. As the plug is inserted, the resin rises to wet the fabric and drives out any entrapped air. Inexpensive wooden molds can be used, reducing the costs of short runs. Gel coats may be used on either of the mold members, and molding cycles range from 1-25 minutes at room temperature.

SPE Regional Conference

New York City's Statler Hotel has been chosen as the site for a regional technical conference on "Plastics in Building," sponsored by the New York Section of the Society of Plastics Engineers, Inc. The date is April 3, and the conference will include two concurrent morning sessions on materials, plus a single afternoon session on applications. Buckminster Fuller will speak during dinner on "Buildings of Tomorrow."

Session I—Decorative Plastics will include the following papers: "Acrylics," Henry Peterson, E. I. du Pont de Nemours & Co., Inc.; "Polyethylene," Fred C. Sutro, Spencer Chemical Co.; "Styrene," James H. Taylor, Koppers Co., Inc.; and "Vinyls & Other Synthetic Textile Fibers," J. F. Nichols, Chicopee Mfg. Co.

Session II—Structural Plastics will include six papers as follows: "Phenolics," Douglas M. Roe, Bakelite Co.; "Polyesters," Charles W. Proudfit, Celanese Corp. of America; "Plastic Foams," M. E. Bailey, National Aniline division, Allied

(*Continued on page 210*)

Reinforced Plastics
(*Continued from page 208*)

(available up to 10 oz. per sq. ft. in weight), more than three times the weight of other mats. It is mechanically bound to prevent contamination by chemicals that might cause discoloration or blistering in production.

Safety helmets, instrument cases, cable clamps, storage bins, and even caskets appeared more prominently in the field as replacement products or as completely new applications.

Consumer-wise, great inroads were made in the swimming pool market; boats; sporting goods like fiber glass fishing rods, bows and arrows; furniture; and trays. In this grouping, we should include the walls for the "House of Tomorrow" whose conception began in early 1956. Sports car bodies, automobile accessories, and radio aerials in color were part of the automotive scene.

One of the most significant strides made by reinforced plastics is its expansion to overseas countries where technical "know-how" agreements have brought American industry together with foreign prospects. Australia, New Zealand, Italy, Germany, and Switzerland are just a few of the countries that were influenced by the successful case histories of reinforced plastics, rather than by the visions of tomorrow.

Although we reviewed the bright side, it is apparent that these successes were not acheived easily, but only through costly trial and error. The high cost of failure was reflected last year by the surprising number of seemingly-successful organizations that went out of business. The reasons for these failures would be interesting topics for discussion. Perhaps some of the readers who were formerly associated with such companies might offer helpful suggestions from their own experience and observation. This could be profitable to all of us. Hindsight is always more practical than foresight.

On the other hand, the story of such failures did not stop large corporations from acquiring smaller reinforced plastics outfits. Evidently, there is sufficient interest and future profit in reinforced plastics to warrant the expenditure of such acquisitions. The reasons for such purchases also are interesting topics for review. Were these corporations interested in diversification only for the tax angle as some contend? Is reinforced plastics "coming of age" sufficiently and lucratively enough to attract these corporations with its promise? Will reinforced plastics materials rival steel and wood in the near future? These questions must have occurred to many of us in the business. Here, again, your views will be of interest.

—THE END

Compression and Transfer Molding
(*Continued from page 208*)

or superior properties. Some efforts have been made by the compression molding industry to reduce molding costs through automation, but so far, the great majority of automatic presses have been sold to captive molders. The combination of an automatic electronic powder preheater with an automatic press makes a very efficient package unit, but the cost is extremely high, and the limited flexibility makes the combination not too attractive to the custom molder.

There are three properties of thermosetting materials (heat resistance, dimensional stability, and surface hardness) which cannot as yet be matched by thermoplastics. In addition, parts with multiple inserts (usually electrical) usually can be molded more economically by compression or transfer. The thermosetting material suppliers and molders together should actively promote these advantages of their materials and not allow the new jobs to go thermoplastic by default.

The Durez Division of Hooker announced plans on February 6 to build a $580,000 production plant for the resin used in their new polyester molding compound. This material has the desirable properties listed above, plus an unlimited color range and a slightly lower price than melamine. Perhaps a material of this type, or the home-mixed polyester "gunks" at a considerably lower price will help slow the trend toward thermoplastics.

This column invites comment on, or questions about, compression and transfer molding, and your editor will be very appreciative of any ideas you may have for future columns.

—THE END

Mold Making and Tooling
(*Continued from page 208*)

as to allow the full scope of this knowledge, or may we call it "molding technique," to be applied. Certainly, this feature should not be minimized. If we take the units of press and molding compound as standard items, then, it is the mold and the molding technique applied to it that would make one molder more successful than another in the performance of a molding operation.

It can be noted from the above that very little was mentioned about actual mold construction. This was done to stress the point that no matter how excellent the mold-making facilities are from the point of view of workmanship, the moldmaker must realize that the performance of a mold is measured through the molding techniques applied to it.

If molding cycles are shortened to increase production or automation is applied to the furthest degree possible, the control of all variable elements of the cycle becomes a vital point. Those elements of control that can be incorporated in a mold should certainly be there. Cooling channels should be ample, with careful planning as to their positioning so as to realize an even temperature distribution. Separate mold portions should have separate and individual systems of cooling for more positive control. Wherever possible, micro-switches should be employed where moving mold details can get out of position and cause mold damage. The runner system and gate details should get their share of attention to balance the even and equal flow of molding compound to each of the cavities.

It is not intended that a moldmaker should have the thorough knowledge of molding techniques that a molder has. However, the moldmaker should have sufficient knowledge to be able to discuss the molder's problems with him, and to be able to incorporate features into the mold to help dispose of these problems.

—THE END

News of the Societies
(*Continued from page 209*)

Chemical & Dye Corp.; "Epoxies," Elliot N. Dorman, Ciba Co.; "Melamines," W. F. Drees, Formica division, American Cyanamid Co.; and "Fiberglas," Richard Adams, Owens-Corning Fiberglas Corp.

Session III—Applications, consists of the following seven topics and speakers: "Designing with Plastics," Jane Fiske Mitarachi, Industrial Design; "Plastics in Lighting," J. B. Orr, Sheffield Plastics, Inc.; "Furniture & Interior Decoration," Adi Fitzner, Fitzner Associates; "Piping & Plumbing Fixtures," Maurice Martin, Bassons Industries; "Plastic Building Components," L. Contini, Monsanto Chemical Co.; "Plastics and Building Codes," Frederick J. Rarig, Rohm & Haas Co.; and "Summary of New Applications," Clayton Meyers, Bakelite Co.

SPE Newark Section

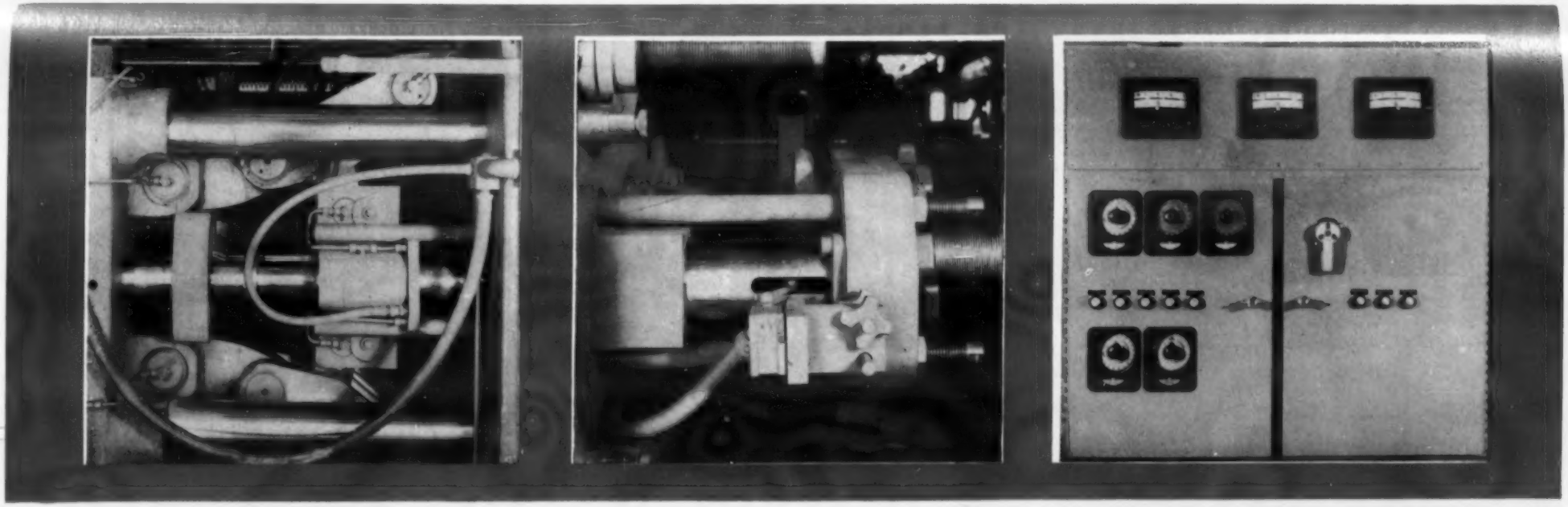
Approximately 65 members and guests attended the February 13 meeting of SPE's Newark Section. As usual, the location was the Military Park Hotel in Newark, N. J.

"Designing Polymers for Plastic Applications" was the subject of a talk by Francis C. McDrew, E. I. du Pont de Nemours & Co., Inc. Shape was declared to be the key to the plastics business, with conversion to this desired shape being the fabricators concern. Difficulties encountered by the processor are stress influence in flexure, both short- and long time at elevated temperatures. The outstanding property requirements for materials were defined as flex modulus and impact strength. Engineering properties of plastics are determined by the degree of polymerization, with useful limits being 150-10,000.

John M. DeBell, DeBell & Richardson Co., discussed the "Selection of Pay-Off Developments," pointing out that one success in four attempts is considered a good average. The critical point in every research or development program is the time when a decision must be made whether to proceed with the program or halt it. Many successful programs were continued in the face of criticism and adverse pressure.

Slides were shown of coated-fabric testing under two-directional stress. These tests determined the type of fabric and type of joining to be utilized in radome housing. The fabric was tailored to shaped sections, joined to form a mushroom housing, and inflated at 0.4 pounds of air pressure. The housing withstood winds up to 150 miles per hour.

(*Continued on page 214*)



Positive Live Toggle Clamp with guided center block for accurate alignment. Stroke is adjustable from 4½" to 14¼". All moving parts automatically "spray-mist" lubricated.

Single point clamp stroke, knockout and cushion adjustment. Stroke may be varied without altering knockout or cushion settings.

Compartmented Instrument Cabinet isolates heat controls from 110 volt cycle control. Features "dead front" safety doors and latest type plug-in timers.

See this new machine operate, March 18-21 at the Pacific Coast Plastics Exposition, Los Angeles, California or send today for Bulletin P-114.

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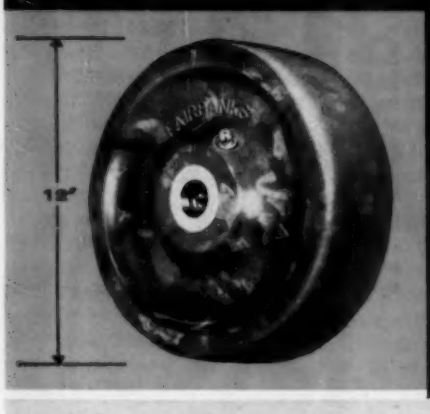
case: Great impact strength, denseness, imperviousness, and superior heat and abrasion resistance obtained with ASP 400 filler at high loading



This is "Lamilon"—internationally-known "family" of nylon-reinforced all-plastic caster wheels in diameters from 3" to 12" made by The Fairbanks Company, New York 3, N. Y.

Mineral Filler Report: Fairbanks states M & C's ASP 400 Aluminum Silicate Pigment filler gives unmatched performance as follows:

a. ASP 400 provides "synergistic wetting and combining action" giving wheels a much higher heat distortion factor than nylon, resin or filler possess in themselves.

b. "Lamilon's" impact strength is double the industry standard . . . water absorption is 90% under . . . abrasion resistance so superior it sets a *new* standard.

c. Long pot life, molding ease, no catalytic effects, no viscosity problems at high loading.

Our business is to supply low-cost non-metallic mineral products that are *process-engineered* to make things go smoothly in your plant . . . well in your markets. Use the coupon.

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For more data, see Chemical Materials Catalog Pages 330-334

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LIMESTONE (*Chemstone*)
SPEEDI-DRI FLOOR ABSORBENTS

SERVICE AND STOCKS IN 30 CITIES

News of the Societies
(Continued from page 210)

Optimism Evident at SPI Reinforced Plastics Meeting

Widespread optimism over current prospects and future potential was evidenced by all branches of the reinforced plastics industry at the 12th annual Exhibit and Technical and Management Conference of the SPI Reinforced Plastics Division, held on February 5-7 at the Edgewater Beach Hotel, Chicago, Ill.

Open to all persons in the reinforced plastics industry, the meeting was attended by 1,200 registrants. The Exhibit consisted of displays by some 57 companies of their recent product developments. They consisted of concurrent technical sessions on the mornings and afternoons of the first two days, concurrent morning sessions on the third day, luncheons on each of the three days, and the Division's annual banquet on February 6. Some 72 papers were presented at the technical sessions, and the session topics were as follows: Tuesday morning, February 5—Three concurrent sessions on "Strength-Time Behavior of Reinforced Plastics," "Structural Design," and "Preforms"; Tuesday afternoon—Three concurrent sessions on "Strength-Time Behavior of Reinforced Plastics," "Cost Estimating and Control," and "Plastics for Tooling"; Wednesday morning, February 6—Four concurrent sessions on "Strength-Time Behavior of Reinforced Plastics," "Engineering—Design and Processing," "International Panel Discussion," and "Metal Mold Makers"; Wednesday afternoon—Three concurrent sessions on "Engineering—Testing," "Aircraft Engineering," and "Materials"; Thursday morning, February 7—Three concurrent sessions on "Engineering—Glass and Finishes," "Premix," and "Safety and Industrial Hygiene." The afternoon of February 7 was devoted to an open forum, where questions from the floor could be directed to the authors of all papers.

This Conference departed from the custom of previous meeting in that it had no planned personal contact periods. The annual banquet on February 6 was preceded by a reception sponsored by the material supplier companies, and followed by a program of entertainment. C. E. Bacon, Owens-Corning Fiberglas Corp., and general chairman of the Division acted as toastmaster at the banquet. A highlight of the banquet was the presentation of the Division's Executive Committee awards for 1957 to John S. Berkson, Alsynite Co. of America; Harold Freeman, American Cyanamid Co.; and W. Brandt Goldsworthy, consultant.

The Division's new color slide film, "Designing with Reinforced Plastics," was presented during the luncheon on February 6. Narrated by W. J. Connelly, Bakelite Co., the film is designed to bring to the attention of product designers and engineers, architects, and top business management the range of use of reinforced plastics. The film and its script can be purchased from the SPI's Public Relations Department, 250 Park Avenue, New York 17, N. Y.

News of the Industry

Reinforced-plastic sections of the Monsanto futuristic house being positioned for thermal and static-load testing.

Test Plastic House Components

Structural design concepts for Monsanto Chemical Co.'s "House of the Future" reportedly have been justified by a five-month test program recently completed by the plastics division's engineering department, Springfield, Mass. Using full-scale major components, the test subjected two 8 by 16-foot reinforced plastic "bents" to static and thermal loads beyond design limits. These "bents", which form the shell of the house, were tested while cantilevered from a test frame.

Static loadings were imposed on the lower and upper halves, both separately and together. Maximum load on the lower (floor) section was 100 psi., and the load on the upper (roof) section was 80 psi. Thermal loadings consisted of hot-water sprays which would raise the temperature of the sections from 34 to 112° F. as quickly as possible. Lessells Associates, Boston, Mass., recorded and analyzed the readings on deflection, elongation, contraction, and internal stress data.

The bents were fabricated by Lunn Laminates, Huntington, L. I., from polyester resins with glass fiber reinforcements. The cost and performance features of 30 layers of glass fabric and 10 plies of woven glass roving were compared during the design and fabrication phase. Production components for the house are being made of the same material at Winner Mfg. Co., Trenton, N. J. Monsanto and Owens-Corning Fiberglas Corp., Toledo, O., are cooperating to make available engineering data developed by this testing and evaluation project.

Irradiated Polyethylene Tape

New facilities at the General Electric plant in Pittsfield, Mass., will enable that firm to produce more than 1½-million pounds of Irrathene per year. An irradiated polyethylene used in the electrical and communications industries, Irrathene had been at the pilot-plant stage for the past two years. The 300,000 pounds available annually were found totally inadequate to meet current and growing demands.

The material is presently being used to insulate telephone and power cables, switchgear, small electronic coils, generators, and large motors. G-E engineers are currently investigating a semi-conducting tape for power cables, an extrusion compound for wire coating and insulating and a new grade of tape which will take physical stress at temperatures beyond 350° C.

A new insulating materials department, under the direction of Louis E. Newman, will engineer, produce, and market the material. Five electron-beam generators will be used to irradiate the material; each generator consisting of a hot-filament source, accelerating coils, and a focusing coil.

In addition to its high-heat strength, other advantages of Irrathene include its ability to shrink-fit under high-heat to the precise contour of almost any object, high-corona starting voltage, low-corona intensity, excellent voltage endurance, and improved insulation resistance.

New Constructions and Costs

The chemical industry will spend an estimated $2.5-billion on new domestic chemical construction during 1957 and 1958, according to a survey by the Manufacturing Chemists' Association, Inc. Construction projects brought into production during 1956 cost more than $1.1-billion. These totaled 354 of the 760 projects included in the survey. An additional 279 projects now under construction will cost an estimated $1.8-billion, and another 128 projects are definitely planned at an estimated cost of $717-million. National statistics show that the chemical industry is making its largest investment, $816-million, in organic chemicals.

Estimated total expenditures for plastics and resin facilities are $394,617,000. Of this total, $124,197,000 was for completed constructions; $245,720,000 for projects currently under construction; and $24,700,000 for projects definitely planned. Plastics and resin construction costs by states are: Texas, $121.4-million; Louisiana, $28.4-million; California, $31.7-million; West Virginia, $35-million; Tennessee, $2.7-million; New Jersey, $45.1-million; Florida, $188.5-million; Ohio, $38.3-million; and Michigan, $23.6-million.

Rapid Assembly with PVC Pipe

Unlimited modifications are possible with unplasticized PVC pipe. This factor has induced Pathecolor, Inc., to install some 10,000 feet of the pipe in the circulating and replenishing systems of its new Kodachrome and Kodacolor processing machines, and in its paper-processing system.

Now in use at the new Bayonne, N.J., plant, the pipe can be cut with a hacksaw and reassembled in a few minutes. It is used to convey 5% potassium ferri-cyanide at 80° F., 1% sulfuric acid at the same temperature, and 3-4% hydrobromic acid at room temperature. In addition to its chemical resistance, the pipe contains no plasticizer that could contaminate the solutions.

Both pipe and fittings were supplied by the Alloy Tube division of Carpenter Steel Co., Union, N.J. The socket-type fittings were cleaned with methyl ethyl ketone, treated with a solvent-cement, and installed with a 90° twist. Pipe sizes used were ½, ¾, one, 1½, and two inches. Fittings included tees, elbows, reduction bushings, unions, and both needle and gate valves.

Unplasticized PVC pipe used in Pathecolor's circulating and replenishing systems.

Aerojet Expansion Program

The structural plastics group of Aerojet-General Corp.'s solid engine division is currently undergoing an expansion program for research, development, and manufacturing. Major activities of the group are in the fields of pressure vessels, thermal insulation, and components for rockets and missiles.

Increased demand for reinforced plastics, including lightweight, adhesive-b o n d e d structures and complex molded forms, has necessitated an all-out expansion of facilities. New buildings and equipment are being procured for the extensive projects already underway, and to provide for future expansion. Aerojet-General is a subsidiary of General Tire & Rubber Corp., with headquarters in Azusa, Calif.

Doubles Manufacturing Space

One of the country's foremost vinyl extruders, the Resinite department of Borden Co.'s chemical division, is doubling the size of its manufacturing plant in Santa Barbara, Calif. This addition of 36,000

square feet of space will enable the firm to increase its production by about 65%, provide for a more extensive research and development department, and increase its facilities for the compounding of raw materials.

Resinite recently broadened its activities in profile and custom extrusions, and plans to become a major producer of PVC compounds for other plastic extruders and molders. Among the products available from Resinite are garden hose, flexible sprinklers, insulation tubing, sleeving, tapes, and cords.

Third Titanium Dioxide Plant

Plans for building a third titanium dioxide plant on a 1,500-acre site near New Johnsonville, Tenn., have been announced by E. I. du Pont de Nemours & Co., Inc. When finished in 1959, the unit will employ 400 persons and will have a capacity of 125 tons per day.

The plant will be operated by Du Pont's pigments department, and will produce the white pigment by a recently-developed "chloride" process. The department's other titanium dioxide plants in Baltimore, Md., and Edge Moor, Del., are both undergoing expansion to meet rising demands for this whitest of white pigments.

Increases Polyethylene Output

Additional production equipment installed at the Longview, Texas plant has enabled Texas Eastman Co. to increase its annual capacity of Tenite polyethylene by 55-million pounds. This is the second major increase since Eastman began commercial deliveries of the material in 1954. Eastman Chemical Products, Inc., New York, N.Y., markets the products of Texas Eastman Co., as well as those of Tennessee Eastman Co. The latter firm also upped its Tenite polyethylene production during 1956 by adding sizeable installations to its plant in Kingsport, Tenn.

Atlas Powder Technical Center

Ground has been broken for Atlas Powder Co.'s new technical center in Wilmington, Del. A $3-million project, the center will enable the firm to intensify its basic research program and expand its technical service to the plastics industry. Completion is scheduled for late 1957.

The center will adjoin the company's general offices in suburban Wilmington, and will provide working space for 200 employes. Technical studies and product development activities now being carried on at the central research laboratory at Atlas Point, will be transferred to the new building, along with personnel of the firm's research and product development department.

Atlas' chemical engineering department, which now operates pilot plant installations at the central research laboratory,

Artist's conception of Atlas Powder's projected technical center in suburban Wilmington, Del.

will take over all of that facility after the other departments move. No production or pilot plant activities will be carried on in the technical center. Design and construction of the new building is being carried out by H. K. Ferguson Co., Cleveland, O.

Wooster Acquires Jamestown

A major producer of houseware and automotive equipment, Wooster Rubber Co., Wooster, O., has purchased the plant, equipment, and inventory of Jamestown Finishing Products, Inc., Jamestown, N.Y. The latter firm will continue to operate as a wholly-owned subsidiary of Wooster, under the name of Jamestown Finishes, Inc.

Jamestown had been a major supplier of plastic dips for Wooster's Rubbermaid line of dish drainers and other coated-wire items, and a producer of plastics and plastic paints. As a Wooster subsidiary, the firm will step-up production of its existing products, and begin producing housewares. All former officers will continue to serve in managerial positions, it was announced.

American Hard Rubber Expands

The entire capital stock of Electric Mfg. Co., San Francisco, Calif., has been purchased by American Hard Rubber Co., New York, N.Y. The West Coast firm is reputedly the country's leading manufacturer of multi-color plastic moldings, such as telephone dials and key buttons for business machines.

The move is said to represent another step in American Hard Rubber's expansion and diversification program. Among the present subsidiaries are Ace Comb Co., Gavitt Wire & Cable Co., Supplex Co., and Pequanoc Rubber Co. Electric's principal officers, E. L. Danielson, president, and Floyd Dofsen, vice president, will continue in their present capacities.

Du Pont Educational Progam

A budget of more than $1-million has been allotted by E. I. du Pont de Nemours & Co, Inc., Wilmington, Del., for grants to education during 1957. This represents an increase of over $100,000 as compared to last year. Fellowships in science, which once made up the entire program, will be continued; however, the largest share will now be apportioned to teacher training.

Du Pont has awarded a total of $585,000 for advancing the teaching of science, mathematics, and fundamental liberal arts subjects. The sum of $149,000 is allocated for post-graduate teaching assistantships, mostly in chemistry, and $61,000 for training high-school teachers of science and mathematics. The other two grants include $290,000 to universities for fundamental research, and $165,000 for post-graduate fellowships in science and engineering.

Begins Full-Scale Production

Styrex 767, a styrene-acrylonitrile copolymer, is now being produced commercially by Dow Chemical Co., Midland, Mich. The material was introduced in mid-1956, and was made until now on a limited scale. A rigid thermoplastic which can be molded or extruded into various shapes and forms, Styrex 767 provides a high degree of clarity in transparent colors. It can also be produced in a broad range of opaque tones.

The copolymer is reported to have an excellent balance of physical properties, including toughness and heat resistance. It is resistant to acids, bases, salts, oils, waxes, soaps, food stains, and many solvents. Among its typical applications are tumblers, rigid food-containers, cutlery handles, dentures, bristles, refrigerator parts, aerosol nozzles, and pencil barrels.

Transfers Press Department

Baldwin-Lima-Hamilton Corp., has completed transfer of the manufacturing and sales operations of its hydraulic and compacting press department from the Eddystone division in suburban Philadelphia, Pa., to the Hamilton division, Hamilton, O. These operations will be integrated with those of the mechanical press department which has always been in Hamilton. There have been no major personnel changes.

NRC Subsidiary Changes Name

Foiltone Products, Inc., Cambridge, Mass., the vacuum-metallizing subsidiary of National Research Corp., has changed its name to NRC Vaculite Corp. The new name identifies the firm with the parent company, and is consistent with the pattern established for other NRC subsidiaries, including NRC Equipment Corp., a manufacturer of high-vacuum equipment; and NRC Metals Corp., which is engaged in the production of rare metals.

Carbide Building Program

Union Carbide & Carbon Corp., has commenced construction of a group of buildings adjacent to its research center in South Charleston, W. Va. Scheduled for completion early in 1958, the new units will serve the firm's development and engineering departments and will house over 1,500 people.

The development department is responsible for turning laboratory chemicals into commercial products and for

developing more efficient manufacturing processes. The new labs will provide facilities for studying continuous processes at pressures up to several thousand atmospheres. A three-story structure will house the pilot plant.

The engineering building will provide space for more than 500 engineers, who are engaged in designing new equipment and plants to meet the needs of Carbide's continuing expansion program. The unit itself will have four wings, and will be five stories high.

Boonton Wins Labeling Award

Grand prize for the best informative label identifying a plastic product was awarded to Boonton Molding Co., Boonton, N. J., for the hangtag on Boontonware. The award was made by Norman Anderson, president of the Society of the Plastics Industry, Inc., at the semi-annual luncheon meeting of the SPI's housewares manufacturers division on January 19, at the Seneca Hotel, Chicago, Ill. The Boontonware label also won the Home Furnishings category award.

Awards in seven other categories were made as follows: Supplex Co., Garwood, N. J., hardware; Loma Plastics, Inc., Fort Worth, Tex., housewares; Federal Tool Corp., Chicago, Ill., housewares; Cohn-Hall-Marx Co., New York, N. Y., floor & wall coverings; Pyramid Rubber Co., Ravenna, O., miscellaneous; and Ringlet Clothespin, Inc., West Boylston, Mass., notions.

Announces Divisional Changes

Food Machinery & Chemical Corp.'s recently-formed organic chemicals division has assumed the responsibility for Ohio-Apex plasticizers, as well as for a variety of specialty organics formerly associated with the Westvaco, Becco, and Fairfield divisions.

Henry W. Winnicki is president of the FMC organic chemicals division, and Bert S. Taylor is manager of the Ohio-Apex division as well as vice president of the newer division. One of the primary aims of the move is to produce and market organic chemicals and plastics developed through the activities of the central research laboratory at Princeton, N. J.

Opens New Fortiflex Plant

A 40-million pounds per year polyolefin plant has been opened by Celanese Corp. of America near Houston, Tex. Located on a 220-acre site, the facility will use the nearby Houston Ship Canal to transport most of its resin production. The molding pellets will then be shipped directly to customers and Celanese distribution centers.

The new resins, made under license

Celanese's Fortiflex plant near Houston, Tex.

from Phillips Petroleum Co., are designated Fortiflex, and will include both conventional and high-density polyethylenes. A semi-works unit had been producing the materials for some time.

Beaver Paint Relocates

A manufacturer of specialized production coatings for the plastics industry, Beaver Paint Co., Inc., has moved from Beaver Falls, Pa., to a new plant at Lake City. The facilities cover more than 12,000 square feet, and are located about 12 miles from Erie, Pa.

Additional production equipment has been added through the recent purchase of Gibbs Paint Co., Cleveland, O. All of the latter firm's physical assets have been taken over by Beaver, and transferred to the Lake City plant.

Nicholson File Buys Danielson

The entire assets of Danielson Mfg. Co., Danielson, Conn., have been purchased by Nicholson File Co., Providence, R. I. The former firm has been reincorporated in the state of Rhode Island as a Nicholson subsidiary, and will continue to operate under the same management.

Danielson supplies molded and extruded nylon products for industrial use under the tradename, Danco. Nicholson management plans to continue the manufacture of Danco products in enlarged plant facilities at the Connecticut site.

In Brief . . .

Interplastics Corp. has moved to new and larger quarters at 120 East 56th St., New York, N.Y. The company supplies a complete line of thermoplastic molding materials for both domestic and foreign use, and also purchases surplus inventories of molding powders and plastic scrap.

Moslo Machinery Co., Cleveland, O., will hold a month-long demonstration on March 11-April 13 at 625 West Jefferson Blvd., Los Angeles, Calif., to show its line of high-speed, automatic molding machinery and test-run customers' molds. Working with its West Coast representative, the Rainville Co. of Calif., Moslo engineers will operate and demonstrate two molding machines, and be available for consultation during the 30-day period.

NEW! DME STANDARD

COMPRESSION MOLD BASES

"Tailor-Made" FOR STOKES MODELS 800 & 741 PRESSES

HERE'S ADDED SAVINGS AND TROUBLE-FREE PERFORMANCE FOR COMPRESSION MOLDERS..!

Available in D-M-E No. 1 or No. 2 Steel.
Cavity plates ground Flat and Square.
Complete range of Cavity Plate thicknesses.
Ready to install cavities or inserts.
Leader pins and bushings–Precision Ground.
Ejector bars drilled to suit K-O Rods.

D-M-E 611-C (6" x 10⅞")
For Stokes Model 800 Press

D-M-E 1315-C (13" x 15")
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Write TODAY *for Complete Prices and Specifications..!*

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News from Abroad

Japanese Geon Opens Plant

Production of PVC at the new Takaoka plant of Japanese Geon Co., Ltd., an associate company of B. F. Goodrich Chemical Co., is underway. Officially opened on November 22, the plant has an initial annual capacity of 6,500 tons, and will employ about 150 workers.

The unit is strategically located on the northwest coast of Japan, where winter snows provide plentiful electric power. The company's original plant at Kambara began production in 1952 with a capacity of 3,000 tons per year. When current expansion at this plant is completed, the combined capacities of the two plants should reach about 25,000 tons per year.

Plastics Fair at Amsterdam

An international plastics fair, to be called Macroplastic, is being organized by the N.V.'t Raedthuis, of Amsterdam, Holland, to be held in that city on November 13-20, 1957. Invitations to exhibit at the fair are going to manufacturers and suppliers of raw materials, semi-manufacturers, finished products, machinery, auxiliary equipment, and miscellaneous materials. The general public will not be admitted.

The enterprise is sponsored by the following Dutch authorities: the Plastics Research Institute of the Technical University, Delft; the National Board of Industry and the plastics industries. An advisory committee has been appointed, including leading personalities in the rubber, chemical, plastics, coal, and oil industries.

Celanese Mexicana Expands

Celanese Mexicana, S. A., an affiliate of Celanese Corp. of America, has begun construction of a new chemical plant near Mexico City. When completed the facility will manufacture formaldehyde and formaldehyde-derived synthetic resins. The move represents yet another expansion by the firm in the plastics field.

Additional facilities will be constructed to house some of the manufacturing and storage operations now located in Mexico City proper. These include units for the production of PVA emulsions and polyester resins, plus a chemical storage tank farm. A new unit for the manufacture of nylon yarn and cord was recently put in operation at Ocotlan, State of Jalisco.

Opens Plastics Laboratories

A number of the best-equipped plastics laboratories in the world have been opened near London, England, by Imperial Chemical Industries, Ltd. Designed for the development of new and better raw materials, the labs have a working area of 56,000 square feet and a staff of 250.

The buildings will house not only conventional chemical and physical laboratories, but also equipment typical of that used in the commercial production of plastic products. There are seven fabricating labs, each containing the latest in semi-scale and production equipment. The molding shop has 12 compression presses, ranging in capacity from 10-250 tons.

Canadian Industries, Ltd., an associate company, has access to the facilities and developments of the parent firm. The Canadian firm will, however, continue to operate its own laboratories for technical service and most application development work in the plastics field.

behind the scenes . . .

There's an air of excitement behind the scenes before the curtain goes up on a fine new plastic like GREX high-density polyethylene. Dress rehearsals for this resin's debut are being conducted continuously in our laboratory's commercial types of extruder and injection molding equipment. Thus we're producing and reproducing the performance data you'll use—and applaud—when GREX is available in commercial quantities. P. S. We're predicting a hit!

GREX*

Clifton, N. J. Baton Rouge, La.

*Trademark for W. R. Grace & Co.'s polyolefins

POLYMER CHEMICALS DIVISION
W. R. GRACE & CO.

Campco Licenses German Firm

An agreement has been concluded whereby Deutsche Tafelglas A.G., Furth, Bavaria, Germany will produce Campco thermoplastic sheet under license from Chicago Molded Products Corp. The German representatives will be trained in this country, and the two firms will exchange technical data and machinery.

Deutsche Tafelglas was organized in 1889, and is a leading manufacturer of plate glass and related products. The firm employs over 2,600 workers at plants in Weidden, Witten-Grengeldanz, and Wernsberg.

Licenses Brazilian Company

Industrias Quimicas Electro Cloro, S. A., a Brazilian subsidiary of Solvay & Cie, have been licensed to use the Phillips-developed catalytic process for making rigid polyethylene. The agreement grants IQEC exclusive use of the patents in Brazil, plus technical know how for its production. The parent firm, Solvay & Cie, previously had been granted exclusive rights to the process in Italy.

Names in the News

William J. Rothemich

William J. Rothemich has been elected a vice president of Interchemical Corp. He formerly served as divisional president of both the R-B-H Dispersions division and, most recently, the textile colors division. **William N. Davies** succeeds him in the latter capacity. **Francis A. E. Spitzer** was named vice president of the firm's international division.

Frank J. Scully has been appointed commercial products sales manager of Zenith Plastics Co., Gardena, Calif., a wholly-owned subsidiary of Minnesota Mining & Mfg. Co. He previously served as sales supervisor, retail trades tape division.

Howard L. Burpo has been appointed Eastern zone manager for Bakelite Co.'s film and sheeting materials division, the area covering the entire Eastern seaboard from Maine to Florida. The division markets Krene calendered and cast plastic film and sheeting, and Bakelite rigid vinyl sheets. **J. P. Raycob** has been appointed technical representative, taking over the sales district formerly covered by Mr. Burpo. The area includes most of New York State, Eastern Pennsylvania, and Northern New Jersey.

Reynolds Marchant has been appointed electronics research consultant for Minnesota Mining & Mfg. Co.'s reinforced plastics division, Gardena, Calif. He became associated with the firm in 1931 as a development engineer, serving most recently as staff consultant in the engineering division.

Dewey H. Nelson, former assistant sales manager of Food Machinery & Chemical Corp.'s Becco chemical division, has been appointed sales manager succeeding the late **John F. Shea.** Mr. Nelson joined Becco in 1947.

W. C. Mueller has been appointed assistant manager of Archer-Daniels-Midland Co.'s newly-formed resin and plastics division. **E. W. Kaufmann,** former regional manager, has been named resins sales manager. Four resin sales regions have been established, with the following men serving as supervisors: **Clyde C. West,** Los Angeles; Earl Erlandson, Chicago; Gale Smith, Cleveland; and **William R. Dodds,** Newark, N. J.

John B. Mackenzie, Jr., has been appointed assistant general sales manager of Haveg Industries, Inc., Wilmington, Del. He previously served as district sales engineer for the firm's Houston, Texas office.

Philip J. Lowry has been appointed manager of the Akron sales district for Mobay Chemical Co. He served as a section chief at Monsanto's Mound Laboratories before joining Mobay in 1954. **L. Dean Tyler** has been named manager of Mobay's Eastern sales district. He had served with Monsanto's plastics division since 1940.

Fabian Bachrach

Berndt K. Lyckberg

Berndt K. Lyckberg has been named general manager of W. R. Grace & Co.'s new high-density polyethylene plant in Baton Rouge, La. Formerly the manager of Firestone Plastics' chemical laboratories, Mr. Lyckberg has been closely associated with the manufacture of synthetic polymers for the past 17 years.

Raymond J. Lodge and **Charles W. Smith** have been appointed department general managers for Borden Co.'s chemical division; the former to head up the resins & chemicals department, and the latter to direct the polyco-monomer department. **Eugene J. Sullivan,** who formerly served as chief administrator for both departments, has been named general sales manager for the entire division.

J. Lee Marsh has been appointed vice president in charge of development for Carbide & Carbon Chemicals Co. A Carbide employe since 1933, Dr. Marsh most recently served as director of engineering.

J. W. McLaughlin

J. W. McLaughlin has been named manager of Bakelite Co.'s film and sheeting division, having been promoted from the position of assistant manager. He joined the firm in 1941 as a technical representative.

Robert C. Sutter has been appointed to the newly-created post of operations manager for Diamond Alkali Co.'s chlorinated products division. **William J. Lightfoot** replaced him as assistant director of engineering. Mr. Sutter has served with the firm for over 17 years.

Harold L. Samuels has been named executive vice president of Victory Mfg. Corp., Chicago, Ill. He formerly served as administrative officer of Doehler-Jarvis Corp., and as a member of Chicago Molded Products' executive committee. **Edward F. Abbott,** former general manager, has been appointed a vice president also.

Charles W. Bayley, Jr., and **Austin I. Weber** have joined the coatings and adhesives department of Borden Co.'s chemical division as research and development chemists. The former will work on latices; the latter on coatings. **Philip E. Coyle, Jr.,** has been appointed a technical sales representative in the Eastern New England area.

George A. Darsie has been appointed Eastern district sales manager for General Electric's silicone products department, and will maintain headquarters at 254 Elizabeth Ave., Newark, N. J. A G-E associate for nearly 10 years, he succeeds **A. L. Baldock** who has been named sales manager of the newly-created insulating materials business at Schenectady, N. Y.

John W. Reid has resigned as vice president of Brown-Allen Chemicals. He disclosed no future plans.

R. R. Payne, Jr., has been named technical representative for Bakelite Co.'s district sales office in Hartford, Conn. His area will include Central Massachusetts and Central Connecticut.

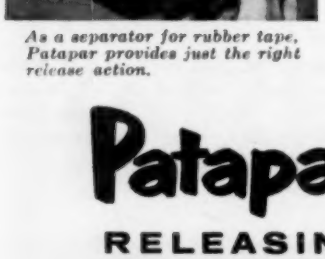
Howard A. Scopp has joined Plax Corp., as manager of polymer chemistry research. He previously served with Olin Mathieson's film division.

New Patapar®

Releasing Parchments

As a casting sheet for polyurethane foams, Patapar gives a smooth satin finish.

Patapar releases easily from pressure sensitive plastics.



As a separator for rubber tape, Patapar provides just the right release action.

peel off easily from pressure sensitive and tacky surfaces

Effective releasing action in almost any situation is provided by new types of PATAPAR RELEASING PARCHMENTS. Features of these Patapars include: dense, fiber-free texture – high resistance to penetration or migration of oil and softeners – permanent releasing action. They are totally inert to any surfaces they contact.

Patapar Releasing Parchments show excellent performance in many processes involving:

- **Synthetic rubbers**
- **Polyurethane foams**
- **Polyesters**
- **Vinyls**
- **Organic adhesives**
- **Organosols**
- **Phenolics**
- **Acrylics**

A brochure of testing samples and detailed information is available on request. If desired, we will give technical assistance and consultation on releasing problems. *Write us on your business letterhead.*

Patapar®
RELEASING PARCHMENT

HEADQUARTERS FOR VEGETABLE PARCHMENT SINCE 1885

Names in the news (Cont'd.)

Richard J. Savage and **Royce G. Freese** have joined Archer-Daniels-Midland Co., as development chemists. The former had been serving as director of product application in the Marco department of Celanese Corp., and Mr. Freese previously was project leader in General Mills' chemical development group.

Thomas T. Engel has been appointed sales manager of Chicago Molded Products Corp.'s dinnerware division. These duties will be in addition to his regular job as advertising manager for the firm.

L. J. Polite, Jr., has been appointed product sales manager for Diamond Alkali Co.'s chlorinated products division. He has served with the company since 1942.

William A. Harshaw II has been elected vice president in charge of research for Harshaw Chemical Co., and **Leslie N. Smith** has been named vice president of the scientific division. Mr. Harshaw has served as sales manager of the development department and as manager of the Philadelphia branch. Mr. Leslie was formerly general manager of his division.

OBITUARY

Fabian Bachrach

Marcel F. Bachner

Marcel F. Bachner, president and treasurer of Chicago Molded Products Corp., died February 21, at the age of 65 years. A resident of River Forest, Ill., Mr. Bachner had been president of the firm since 1954, treasurer since 1943.

Mr. Bachner was born in Sterling, Ill., and attended Austin High School in Chicago. He was associated with Western Electric Co., for seven years before joining with his five brothers in forming Plymouth Mfg. Co., in 1919. The latter firm is known now as Chicago Molded Products Corp., a leading molder and manufacturer of thermoplastic sheet material.

Services were held at St. Luke's Catholic Church, River Forest, followed by interment in Queen of Heaven Cemetery, Hillside, Ill. Mr. Bachner is survived by his widow, Henrietta; two sons, Henry and Leonard; three brothers, Maurice, Edward, and Louis; and a sister, Mrs. Virginia Bird.

New Materials

Write item numbers on Readers' Service Card to obtain more information.

Epoxy-Impregnated Glass Cloth

An epoxy-impregnated glass cloth, designed to provide unfilled, self-extinguishing laminates of superior physical and electrical properties, has been introduced by Standard Insulation Co. Designated Stanpreg, the cloth is furnished in dry, non-tacky rolls or tapes of uniform resin content.

Stanpreg epoxy resin can be provided with any style of glass cloth or finish. Considerable latitude is permitted with respect to curing conditions, and laminators can develop their own cycles based upon existing equipment. The suggested range of conditions, dependent upon the thickness of the laminate, extends from 10-60 minutes at pressures of 100-1,000 psi., and temperatures of 300-350° F. Cauls, previously conditioned with release agents, are recommended for use between the laminate and the press platens. Press padding also is recommended, so that an even distribution of pressure may be exerted upon the laminate.

Data obtained on a ⅛-inch laminate of 150-yarn Stanpreg with Volan finish are reported as follows:

Flexural strength flatwise, psi.,	
cut lengthwise	65,100
Cut crosswise	61,100
Impact strength edgewise,	
ft. lbs./in., cut lengthwise	13.25
Cut crosswise	10.01
Water absorption, wt. change,%	0.1
Volume resistivity, megohms-cms	8.3×10^7
Surface resistance, megohms	2.5×10^7
Dielectric breakdown, kilovolts	71.3-83.8
Dielectric constant, 1 mg	4.68
Dissipation factor, 1 mg	0.018
Insulation resistance, megohms	1.8×10^7
Arc resistance, sec.	126
Heat distortion temperature, °F	324
Flammability, in./min.	Self-extinguishing

Readers' Service Item M-1

Reduced-Cadmium Pigments

A new type of reduced-cadmium pigments have been developed by Ferro Corp.'s color division. Called Cadmopones, the materials are reported to be extremely light and fluffy and disperse easily in all plastic materials. Permanent, non-bleeding, and non-fading, the Cadmopones are currently available in the following colors: medium red, orange red, and orange.

Cadmopone pigments are highly resistant to light, heat, acids, and alkalis. Properties are reported as follows:

	F-11886 Orange	F-11887 Orange-Red	F-11888 Red
Specific gravity	3.5	3.5	3.5
Bulking value, loose, gm./cu.in.	4.95	5.05	4.75
pH	7	7	7
Particle size, microns	0.8	0.98	0.83

Readers' Service Item M-2

Low-Toxicity Epoxy Hardeners

Two water-repellent hardeners for epoxy resins, reportedly non-dermatitic over a two-week, patch-test period, have been placed on the market by Furane Plastics, Inc. Designated Hardeners 946 and 986, the materials were applied in undiluted aliquots of 0.01 milliliters to the same area of skin for a period of 15 days.

Hardener 946 is a brown liquid with a pot life of 10-15 minutes at ambient room temperature when used with surface-coat resins, laminating resins, and casting resins. The amount recommended for use in epoxy formulations runs about 20%, and the finished resin is dry to the touch in about half the time required for amine-type hardeners.

Hardener 986 is moderately viscous, and has a pot life of 20-30 minutes A general purpose hardener, the material is added to epoxy formulations in approximately the same proportion as Hardener 946.

Extensive tests on ASTM heat distortion temperature show little or no change when the proper amounts of non-dermatitic hardeners were used. In addition, the flexural and compressive strengths were equal or superior to those resins incorporating standard-type hardeners.

Readers' Service Item M-3

Extrudable Fluorocarbon Resin

A perfluorocarbon resin, approaching the heat- and chemical-resistance of Du Pont's Teflon but with a melt viscosity low enough to permit extrusion with standard equipment, has been introduced by that firm's polychemicals department. Called Teflon 100-X, the new material is expected to make the essential properties of Teflon available over a broad range of applications previously not attempted because of processing difficulty.

Teflon 100-X is readily extruded as film, tubing, and wire insulation. Uses include chemical hose, bottles, bags, jacketing, liners, and electrical insulation on aircraft- and electronic hook-up wire. It is available as ⅛-inch, cube-cut pellets.

Properties are reported as follows:

Melting point, °F	545-563
Melt viscosity, poises	$6\text{-}8 \times 10^4$
Crystallinity, %, quenched	40-50
Annealed	50-57
Specific gravity	2.145-2.17
Tensile strength, ultimate, psi. at 73°F	2,700-3,100
At 392°F	600-700
At 453°F	450-500
Yield point, psi. at 73°F	1,900
At 392°F	450-700
Elongation, ultimate, % at 73°F	250-330
At 392°F	200-250
At 452°F	150-250
Flexural modulus, psi. at 73°F	$80\text{-}85 \times 10^3$
At 212°F	$15\text{-}18 \times 10^3$
At 392°F	$5\text{-}8 \times 10^3$
Flex life, MIT, 1,200 gm. load, 5-7 mil film, flex	4,000-7,000
Heat distortion point, °F, at 66 psi.	162
At 264 psi	129
Brittleness temperature, °F	—130
Flammability	Nonflammable
Hardness, Durometer D	55
Abrasion resistance, Taber CS-17, 1,000-gm. wt., mg./1,000 cycles	30-35
Thermal conductivity, Btu./hr./sq. ft./°F./in.	1.35
Coefficient of friction against steel	0.09
Water absorption	None
Dielectric strength, 15-mil film, volts/mil	1,150-1,550

Readers' Service Item M-4

Industrial Adhesive Line

A line of eight thermosetting and one thermoplastic adhesives for industrial applications has been introduced by Raybestos-Manhattan, Inc. Designated Ray-Bond, the adhesives are available in different viscosities suitable for spraying or painting. Choice depends largely upon the equipment and the condition of the contact surface.

Thick films are built up using the higher-viscosity adhesives; however, films in excess of 0.007-0.008 inch generally give weaker bonds than ones which are uniformly thin. A special primer, Ray-Bond Primer R-4014, is available for effecting a deeper penetration of the more viscous adhesives.

Ray-Bond R-114 has a synthetic rubber-phenolic base, and is recommended for adhering plastics to metal. Properties include a viscosity of 1,040-3,540 cps. at room temperature, a solids content of 19-27%, weight per gallon of about eight pounds, and a room-temperature shear strength of 1,656 psi. Its solvent is methyl ethyl ketone.

R-476 has a phenolic base, and its low

viscosity of 74-77 cps. requires that there be intimate contact between bonding surfaces. Other properties include a solids content of 37.5% a weight per gallon of 8.04 pounds, a heat-decomposition point of 650° F., and a shear strength at room temperature of 2,500 psi. Spray application is recommended, and the solvent is is denatured alcohol.

R-706 has a phenolic base, and is recommended as a sealer for electrical equipment. Solids content is 77.8%, weight per gallon is 12.39 pounds, decomposition point is 650° F., viscosity is 2,450 at room temperature, and shear strength at this temperature is 2,450 psi. The solvent is denatured alcohol.

R-4015 phenolic-based adhesive is suitable for both high- and low-temperature applications, and can be applied by brush- or roller coat. Properties include a 45% solids content, a weight of 8.6 pounds per gallon, decomposition point of 650° F., a shear strength of 2,500 psi., and a viscosity of 740-770 cps. at room temperature. Solvent is denatured alcohol.

R-4017 has a phenolic base, a solids content of 45%, a weight per gallon of 8.08 pounds, and a viscosity of 48-50 cps. at room temperature. It has the same shear strength, solvent, and decomposition point as the above-mentioned adhesive, and is intended for spray application.

R-4025, a phenolic-based adhesive, is recommended for applying friction material to brake shoes. Heat resistant, it can be applied by brush or roller coat. Solids content is 36.7%; weight, 7.91 pounds per gallon; and viscosity 1,250 cps. at room temperature.

R-4029 has a modified phenolic-resin base, and is formulated to impart flexibility and toughness to the cured film. Solids content is 37-38%, and weight per gallon is 7.88 pounds. Viscosity is 1,940-1,950 cps. at room temperature.

R-4021 is a thermoplastic adhesive with a neoprene base. Intended for assemblies with poor contact between the mating surfaces, it permits films up to 0.015-0.02 inch to be built up. It contains 26% solids, weighs 7.77 pounds per gallon, has a peel-strength of 40 psi., and a viscosity of 1,650 cps. at room temperature. The solvent is toluene.

R-4024 is a two-component epoxy adhesive which gives exceptionally high-strength bonds. Intended for spread application, it has a 100% solids content. Weight per gallon is 15.74 pounds and there is no solvent. Tensile strengths at room temperature vary from 1,700-2,850 psi., depending upon the temperature of cure.

Readers' Service Item M-5

VANSTAY Z

zinc bearing chelator for PVC resins imparts outstanding clarity, stability and resistance to sulfur staining when used as recommended with other VANSTAYS in many vinyl products.

Plastisols, Organosols, Extruded Goods

Use 1.5 VANSTAY R with .5 VANSTAY Z for maximum resistance to process heat and good service life.

Film, Sheeting, Molded Products

Use 1–1.5 VANSTAY HT with .5–1.5 VANSTAY Z to obtain the required protection.

When Roll plating is a problem:

Use 1.5 VANSTAY N with 1.5 VANSTAY Z as the stabilizing system.

Our Technical Service Representatives will gladly demonstrate the merits of our materials in your plant and assist in solving production problems.

Oliver

R. T. Vanderbilt Co., INC.
230 PARK AVENUE, NEW YORK 17, N. Y.

Non-Woven Acrylic Fiber Mats

A non-woven textile mat, developed for a variety of industrial purposes, has been placed on the market by Felters Co. Consisting of multiple webs of Dynel, Carbide & Carbon Chemicals Co.'s acrylic fiber, the mat is available as a resilient sheet material in various thicknesses, densities, and surface textures.

A thermoplastic, Dynel mat can be permanently folded or creased. It can be molded into special shapes, and surfaced with strengthening ribs or embossed designs. A moisture absorption of less 0.5% prevents the mat from losing its original dimensions even after repeated washings.

Dynel mats are available as low- or high-density, regular or course stock. Weights range from 2-14 ounces per square yard. High chemical- and low-electrical resistance make it useful as a separator in the long-lived, nickel-cadmium, alkaline batteries. Other uses include filtering air and corrosive liquids, fabricating gaskets and weather-stripping, linings for clothing, shoe inserts, supports for plastic sheeting, sound absorbers, and diaphragms.

Depending on end-use requirements, Dynel mat can be made with low- or high-tensile strength, and in density ranges of 5-25 pounds per cubic foot. The mat is currently manufactured in 72-inch rolls, 45 yards in length. Thicknesses range from 1/32-1/4 inch.

Readers' Service Item M-6

FEWER REJECTS—HIGHER RESIDUAL STRENGTH PROVED

...in production run of Vacuum Formed Door Liners with

MONSANTO LUSTREX Styrene Plastic

Here is a doubly critical operation of sheet extrusion and final vacuum forming of impact-proof refrigerator door liners. Quality requirements for these finished liners are high! The raw material must extrude sheets that are easily vacuum formed into complex die shapes. At the same time, cycles must be rapid. The refrigeration end use requirement demands an odor-free styrene. But most important, high vacuum forming temperatures cannot affect basic strength of the finished door liners! These are rigid specs for any material.

In a recent run of 7,350 liners, Lustrex Hi-Test 88B met and exceeded these requirements. Paul Schmidt, Chief Thermoplastic Engineer of the Panelyte Division of St. Regis Paper Co., reports, "Working with extremely complex dies, sheets extruded from Lustrex Hi-Test 88B give us excellent resilience and constant flow regardless of high heat cycles ranging from 350°-500°F. In addition, resultant strength characteristics are maintained at a steady peak level." The finished vacuum formed Lustrex liners also pass the "slam door test"—an over-loaded door slammed shut thousands of times to simulate years of actual use. Performance like this cuts rejects at the assembly level to a fine minimum . . . proof again of Lustrex performance and economy.

Investigate the moldability, strength and economies of Lustrex Hi-Test 88B for your next difficult requirement. Write for complete technical data to Monsanto Chemical Company, Plastics Division, Room 1852, Springfield, Mass.

LUSTREX HI-TEST 88-B

MONSANTO

New Equipment

Write item numbers on Readers' Service Card to obtain more information.

Model 30-0 plastic packager.

Plastic Packaging Machine

The Model 30-0 Plastic Packaging Machine has been placed on the market by Plastic Packaging Machinery Co., Inc. Designed specifically for the production of "skin" packages, the unit will make plastic bubbles or blisters for contour-type packaging.

The operator places printed, coated cards in the packaging box; centers the item to be packaged; places a sheet of plastic film over the item or items; pulls the heater forward; and, approximately six seconds later, pushes the heater back and removes the finished pack.

The unit uses a quartz-tube, infra red heater which operates at 6,500 watts. The automatic vacuum-exhaust valve is solenoid-operated, and the weightless clamping frame is spring-loaded. Other specifications are reported as follows:

Maximum size accommodated, in.	20 x 24
Box depth, in.	1-4
Heat cycle time, 0.005-inch butyrate, sec.	5
Vacuum tank capacity, gals.	100
Floor space, in.	40 x 65
Height, in.	52
Shipping weight, lbs.	1,000

Readers' Service Item E-1

Tramp Metal Detector

An electronic unit for detecting unwanted metal particles in non-metallics has been developed by J. W. Dice Co. Designated Model TM Metal Detector, the unit is custom-made to customer specifications. Basic dimensions of the unit are 20 by 16 by 22 inches, with the size and shape of the pick-up coil being the varying factor.

Plastics, foods, lumber, textiles, rubber, paper, confections, pharmaceuticals, cement, ceramics, and stone can be inspected automatically for the presence of both ferrous and non-ferrous tramp metal at conveyor speeds up to 1,000 feet per minute. These particles are picked up by the test coil, which causes a reject relay to operate the electronic unit. The relay, in turn, can be used to sound a warning gong, trigger a marking device, or operate a reject gate.

Operation is controlled by a 115-volt, single-phase lighting circuit. Particle-size sensitivity varies with the type of metal particle involved, and will run from 0.04-0.3 inch depending upon this factor and the cross-sectional area required in the inspection aperture.

Dice tramp-metal detector.

Readers' Service Item E-2

Custom-Calibrated Thermometer

A new concept in thermometers, 100% accuracy at a single, desired point, has been adopted by W. C. Dillon & Co., Inc. This firm's new instrument is custom-calibrated at any point between −40 and +1000° F., or between −10 and +300° C. Standard thermometers encompass a wide temperature range, and must necessarily operate within a limited accuracy tolerance.

Dial housing of the Dillon thermometer measures $1\frac{11}{16}$ inches, and the actual dial diameter is $1\frac{7}{16}$ inches. The model shown in the accompanying photograph is equipped with a plain bushing; however, ½-, ¼-, ⅜- and ⅜-inch N.P.T. or ⅜-24 by ½-inch N.F.-thread mounting nuts are available. Stem length can be 2½-70 inches, as desired. All parts, with the exception of the enclosed dial, are made of type 304 stainless steel.

Dials are furnished in glare-proof, satin black with white figures and red-filled reference mark. A notarized certificate of calibration is furnished with each instrument.

Dillon's custom-calibrated thermometer.

Readers' Service Item E-3

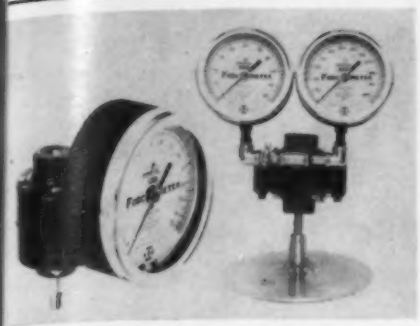
Rigid-Plastics Drilling Tool

A new tool, originally designed for drilling light-gage metals, has been found particularly suited to drilling burr-less, chip-free holes in thin (0.005-⅜ inch) rigid plastics and laminates. Designated Roto-Bor, the tool is available from Jancy Engineering Co. in 54 stock sizes ranging from $\frac{3}{16}$ to $1\text{-}\frac{9}{32}$ inches.

Roto-Bor can be used in portable or stand drills at the normal spindle speeds of high-speed drills. An axially-retracting center point facilitates accurate positioning, and is removable for resharpening. On layout work, the tool often can eliminate jig-boring, punch-press setups, sequence drilling, and the need for vises and clamps.

Roto-Bor tool drilling holes in Lucite.

Readers' Service Item E-4



Models 150 and 300 Forcometers measure mechanical force.

Mechanical Pressure Gage

An indicating device which will measure any mechanical load, force, or thrust by conversion to a proportional hydraulic pressure has been placed on the market by Charles W. Schneible Co. Called the Forcometer, the unit employs a diaphragm-type assembly and is specially recalibrated to read directly in mechanical force.

Different models are offered with different size diaphragms and related parts. Heavy loads may then be determined without involving excessive hydraulic pressures, and conversely, very small loads are determined without the complications of measuring very low hydraulic pressures.

For covering unusually-wide ranges, the instrument is available with two dials. Switch from one range to another is accomplished merely by opening or closing the valve.

The Forcometer has an aluminum housing, aluminum and stainless-steel hardware, and includes a 4½-inch dial as standard equipment. Accurate to 0.25%, the unit can be adapted to measure tensile loads through the use of suitable jigs. Standard models are the 150, which measures 15-100 pounds; and the 300, which measures in the range of 50-600 pounds.

Readers' Service Item E-5

Dual-Valve Steam Trap

A light-weight model, 70-T, has been added to Perfecting Service Co's. line of Unitrap bucket-type steam traps. Developed for low-pressure, high-condensate rate applications, 70-T is available in ½-inch pipe size and has a universal pressure range of 0-125 psi.

The trap operates on a balanced pressure principle, using the new Dual-valve which automatically compensates for differential pressures through the above-mentioned range. Positive valve-seating prevent wire draw and loss of steam. Other features are included in the following list of specifications:

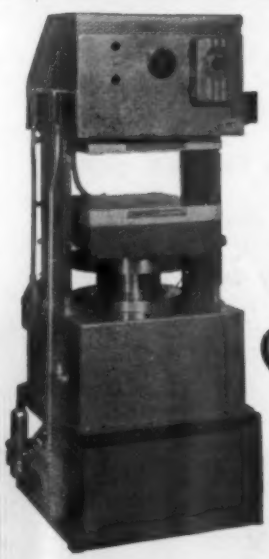
Type 70-T Unitrap steam trap.

Capacity, lbs./hr.	0-1,000
Main valve orfice diameter, in.	3/16
Flange diameter, in.	3⅜
Overall height, in.	4 7/16
Weight, lbs.	3¼

Readers' Service Item E-6

HYDRAULIC PRESSES

20 tons to 500 tons ram pressure



Platen area 8 to 24 inches

Motorized hydraulic system

Controlled platen temperatures to 600° F

Automatic time cycler

Customized to your requirements

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plus QUALITY

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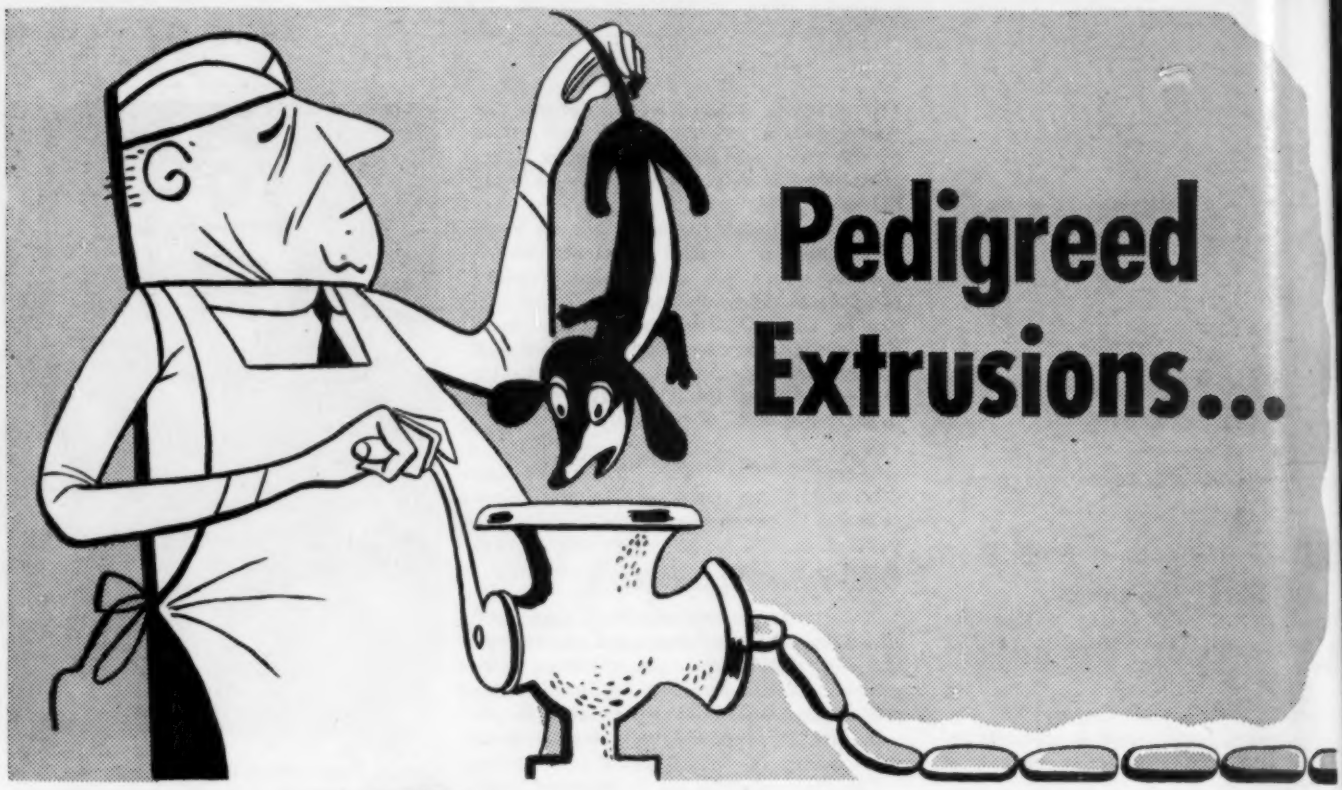

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with... CYCOLAC®

New HIGH-IMPACT THERMOPLASTIC RESIN

THE PERFECT RESIN FOR THE MANUFACTURE OF ANY PRODUCT THAT DEMANDS . . .

- Chemical Resistance
- Lightweight
- Non-Corrosion
- Dimensional Stability
- High Impact Strength
- Machineability
- Economic Molds
- Low Brittle Point
- High Heat-Distortion

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Extruded items for high production of sheet, pipe, or profiles; calendered sheet stock for post-forming operations; injection molded items for high gloss, dimensional stability. All products characterized by high impact resistance, bright colors, chemical resistance, low brittle point, low creep and excellent electrical properties.

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Marbon®

MARBON CHEMICAL

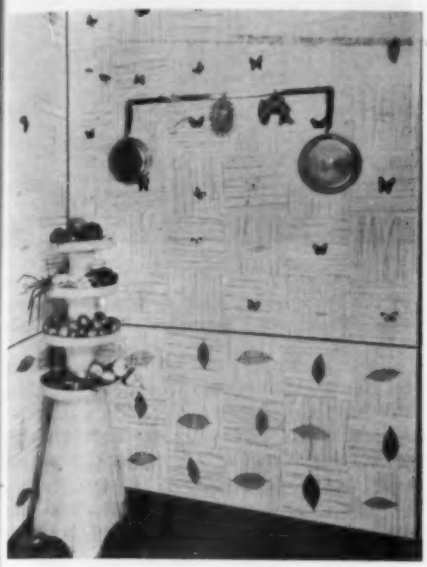
Division of BORG-WARNER

GARY, INDIANA

MARBON CHEMICAL . . . *Precision Resins for Precision Made Products*

New Products

Write item numbers on Readers' Service Card to obtain more information.



Butterflies and leaves bonded between vinyl films form attractive wall pattern.

Vinyl-Laminate Wall Tiles

Square wall tiles, consisting of delicate decorating materials locked between Bakelite's rigid vinyl sheeting, have been placed on the market by Laminated Plas-Tex Corp. Called Lam-O-Tile, the 10-inch squares offer many combinations of color, pattern, and texture. A specially-prepared adhesive bonds the tile to almost any clean, dry surface such as plaster, masonry, wood, glass, ceramics, and concrete.

Readers' Service Item P-1

Vinyl-Rayon Laminate

A translucent, vinyl-rayon fabric, which has an esthetic as well as a protective function, has been introduced by Herculite Protective Fabrics, Inc. Called Herculite, the fabric is a laminate of Celanese's open-weave Fortisan-36 rayon and two outer layers of Bakelite's Krene vinyl film.

A Herculite awning was recently chosen by the Museum of Modern Art in New York City to protect its exhibit, "Textiles U. S. A." Weather-resistant, the awning measured 104 by 17 feet.

Herculite vinyl-rayon awning.

Readers' Service Item P-2

Reinforced Plastic Truck Top

A fibrous glass-reinforced polyester truck cover, which converts an open-bed pick-up truck into a weatherproof panel model, has been introduced by Glas Laminates, Inc. Designed to fit ½- or ¾-ton trucks, the one-piece cover is installed in a matter of minutes.

The smaller model weighs only 130 pounds, and is extremely resistant to impact. Two men install the unit, using four bolts with wing nuts. The cover rests on sponge rubber, and both windows and doors are sealed in the same manner.

The larger model, weighing approximately 300 pounds, has a full-length rear door with lock and five, crank-out windows. Equipment such as bunks, shelves, sink, tables, and fishing racks are easily installed. Polyester resin used in this application is Plaskon, supplied by Allied Chemical & Dye Corp.'s Barrett division.

Readers' Service Item P-3

Vinyl-Carpet Stair Treads

Carpet stair treads, made from B. F. Goodrich Industrial Products Co.'s Koroseal vinyl plastic, have been introduced by Natco Products Corp. Superior to rubber in aging and abrasive strength, the treads offer outstanding resistance to scratching, scarring, ripping, and tearing.

Tread texture is designed for ease of cleaning, since it has no deep grooves to catch dust and lint. A non-skid traction texture is built into the design, and softens the noise of footsteps. Four different colors are available; rose beige, leaf green, dawn grey, and cocoa brown.

Vinyl stair treads and landing mats.

Readers' Service Item P-4

Slip-Type Expansion Joint

An unplasticized PVC slip-type expansion joint has been introduced by Tube Turns Plastics, Inc. Available in one-, two-, and three-inch sizes, the joints may be used with piping of smaller diameters through the use of reducing bushings. All permit an expansion of 3¾ inches, and will withstand pressures up to 325 psi.

The joint is designed for use with rigidly-fixed PVC piping subjected to thermal cycles. It has a neoprene O-ring packing, and is suitable for a wide range of corrosive services. When made from normal-impact PVC, the one-inch size has a pressure rating of 205 psi. at 75° F., and 120 psi. at 140° F. Two-inch joints have pressure ratings of 170 and 100 psi., respectively, at the above-mentioned temperatures. The three-inch size is rated at 150 and 90 psi., respectively, for the same two temperatures.

PVC expansion joints of one-, two-, and three-inch diameters. In each pair, the left joint is closed and the right joint is open.

Readers' Service Item P-5

Cryovac film pouch packages luncheon meat.

Air-Tight Vacuum Pouches

A new line of vacuum pouches for the food packaging trade has been placed on the market by Cryovac Co. Made from a specially-treated polyethylene, the film is highly impervious to moisture and the transfer of gases. The pouches are available in a wide range of sizes suitable for sliced luncheon meats, cheeses, frozen meats, frankfurters, sausage, and similar products.

The pouches are said to have all the advantages of laminated pouches without their disadvantages. Properties include high tear strength, excellent flexibility, and clarity. Comparative rates of gas transfer for Cryovac pouches, untreated polyethylene, and MSAT cellophane are tabulated below. Test conditions involved 100 square inches of film, one atmosphere of pressure, room temperatures, and 24-hour periods.

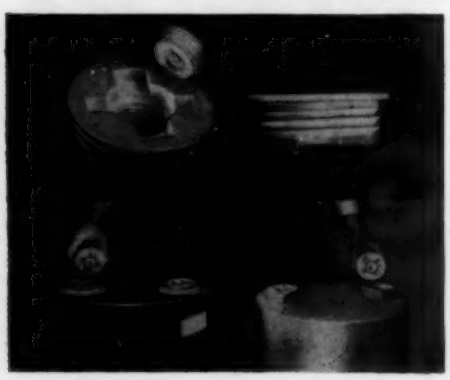
	Nitrogen	Oxygen	CO_2	Air
Untreated polyethylene, cc.	142	344	899	149
MSAT cellophane, cc.	32	43	111	35
Cryovac pouch, cc.	3.1	11	27.1	5.1

Readers' Service Item P-6

Polyethylene Drum Closures

Low-pressure polyethylene closures for I.C.C.2-S molded polyethylene drums have been developed by Delaware Barrel & Drum Co. The closures consist of two identical flanges with heavy-duty internal buttress threads. Each flange takes a two-inch plug with mating buttress threads, and fitted with a pliable polyethylene gasket.

The plugs are molded with ¾-inch standard pipe threads in the center. A diaphragm seals the bottom, but is easily cut away for installing spigots, valves, or pipes. The new closures eliminate the possibility of damage to the flange and threads, facilitate filling and emptying, and extend the life of the drum.



Molded polyethylene flanges and plugs.

Readers' Service Item P-7

Resilient Styrene Light Pans

Impact-resistant polystyrene pans for fluorescent light fixtures have been introduced by Sheffield Plastics, Inc. Known as Sheffield UVR pans, they are sufficiently resilient to withstand a 90° twist without cracking or breaking.

Other essential features are white initial color, the high light-transmission, and light stability after prolonged usage. Similar to the firm's UVR shields, the pans are intended for use with troffer or recessed-type fixtures in which the pan covers the entire face. All light must, then, be transmitted through the pan.

Light transmission of UVR styrene pans is evidenced in above photo.

Major deterrents to more widespread use of plastic pans in lighting fixtures have been the relatively high cost of acrylics, and the poor light stability of vinyls. These difficulties are reportedly obviated with the vacuum-formed styrene pans.

Readers' Service Item P-8

Vinyl Frames and Holders

The triple glass windows in Col-Temp super-market refrigerators are kept free from sweat without the use of expensive heaters, thanks to a vinyl gasketing installed by Simplex Mfg. Co. Rigid vinyl extrusions serve as frames for the doors and as holders for the gaskets Low in thermal conductivity, these frames reduce the amount of refrigeration required to keep foods at the optimum temperatures.

Vinyl gasketing between the three glass panes of this refrigerator door prevent sweat formation. Rigid vinyl extrusions form the frame.

Both gasketing and frames are produced by the plastics division of B. F. Goodrich Products Co., Marietta, O., using the firm's Koroseal vinyl resins. The door channels are 1¼-inch wide and $\frac{3}{32}$-inch thick, and are light green in color. Plastic channels impose less wear on the hinges, and their lower weight reduces shipping costs.

Readers' Service Item P-9

Shatterproof Vinyl Window

A shatterproof, non-flammable window of Seilon rigid PVC has been placed on the market by Seiberling Rubber Co. Intended primarily for industrial installations, the

Vinyl window withstands full force of hurled baseball without cracking or breaking.

window is resistant to corrosive fumes, dust, high winds, and intense heat.

Seilon windows are available either clear or as a translucent glazing which filters up to 80% of the sun's glare. As a building material, Seiberling recently produced a 500-pound sheet, which measured 48 by 96 inches and was two inches thick. The firm also manufactures 1¼-, 1½- and 1¾-inch sheets.

The window is expected to be valuable in school constructions due to its high impact qualities. Other anticipated uses include school runways, greenhouses, patio roofs and sides, carports, and breezeways. The material can be worked with conventional wood or metal tools.

Readers' Service Item P-10

Uniformly-Rated PVC Pipe

A line of thin-walled PVC pipe with a uniform pressure rating in all sizes has been introduced by Carpenter Steel Co.'s Alloy Tube division. Known as Schedule PR-150, the series' thinner walls give it a greater flow capacity than conventional piping of the same nominal size.

Two basic types are available: Carpenter PVC No. 1, a chemically-resistant pipe with a maximum working pressure of 150 psi. at 75° F.; and Carpenter PVC No. 2, a high-impact piping with a rating of 125 psi. at the same temperature. The working pressures are constant in all pipe sizes.

The unplasticized pipe is marketed in eight sizes ranging from ½-4 inches. Wall thicknesses range between 0.05-0.23 inch. All pipe in the series is furnished in standard 10- and 20-foot lengths with plain ends. A full line of socket solvent-cement fittings is available.

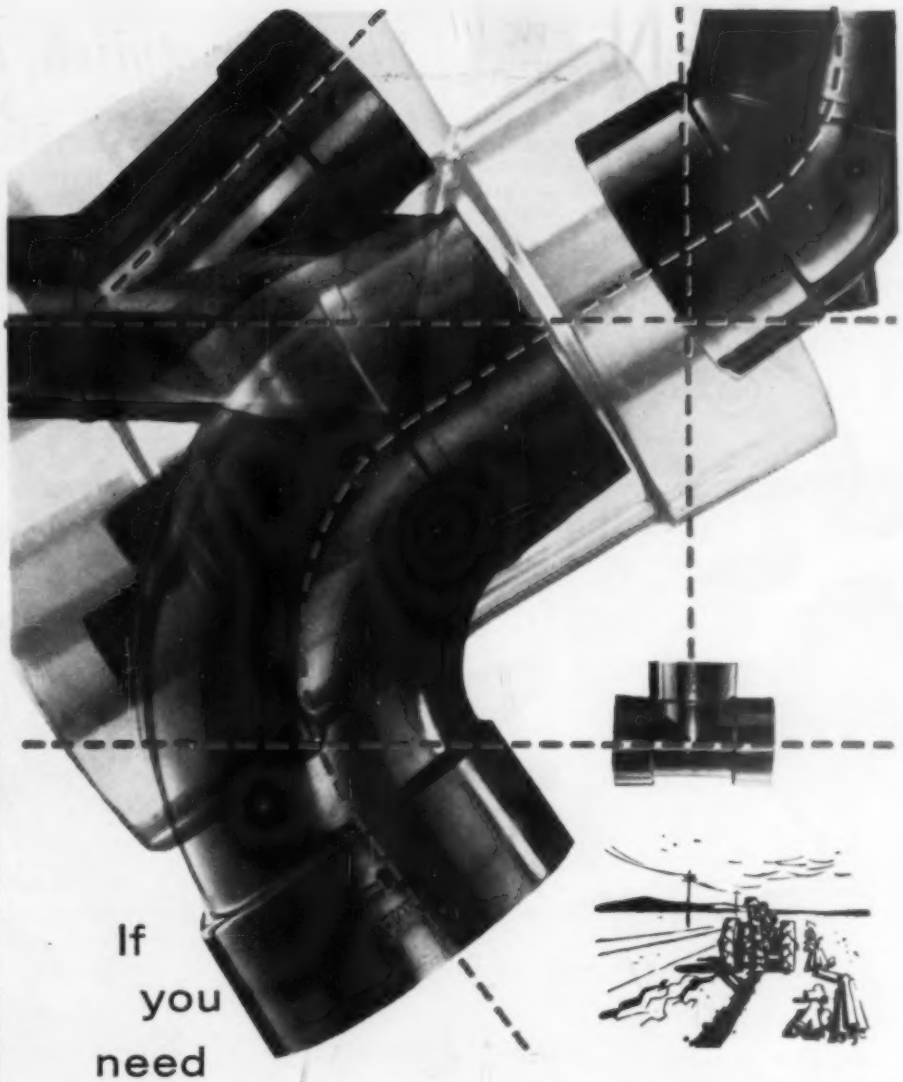
Readers' Service Item P-11

Metallized Rigid-Vinyl Sheet

Metallized rigid vinyl sheeting which will not burn has been introduced by Gomar Mfg. Co. under the trade name Metalcote. Intended for vacuum-formed display pieces, toys, Christmas ornaments, and the like, Metalcote is available in a full range of colors.

The material can be formed in both deep and shallow shapes. When subjected to direct flame, it shrivels, but will not burn or explode. Three gages are available; one, five, and ten mils. Metalcote is supplied in 1,000-foot, 24-inch wide rolls.

Readers' Service Item P-12



If you need **chemical** and **solvent resistance**

...count on **Plenco**

PIPE GOING IN—into earth potent with destructive forces: Water, solvents, acids and alkalies; salts, fungi, bacteria and electrolytic action. That's why special Plenco formulations are being used for the production of underground pipe drain fittings.

Of course, no one material can give complete protection from all these factors in all degrees, indefinitely. Plenco phenolic molding compounds, however, have much to offer on applications of this type and others. Their insoluble, infusible and chemical resistant character has shown an increasing variety of manufacturers that you can count on Plenco.

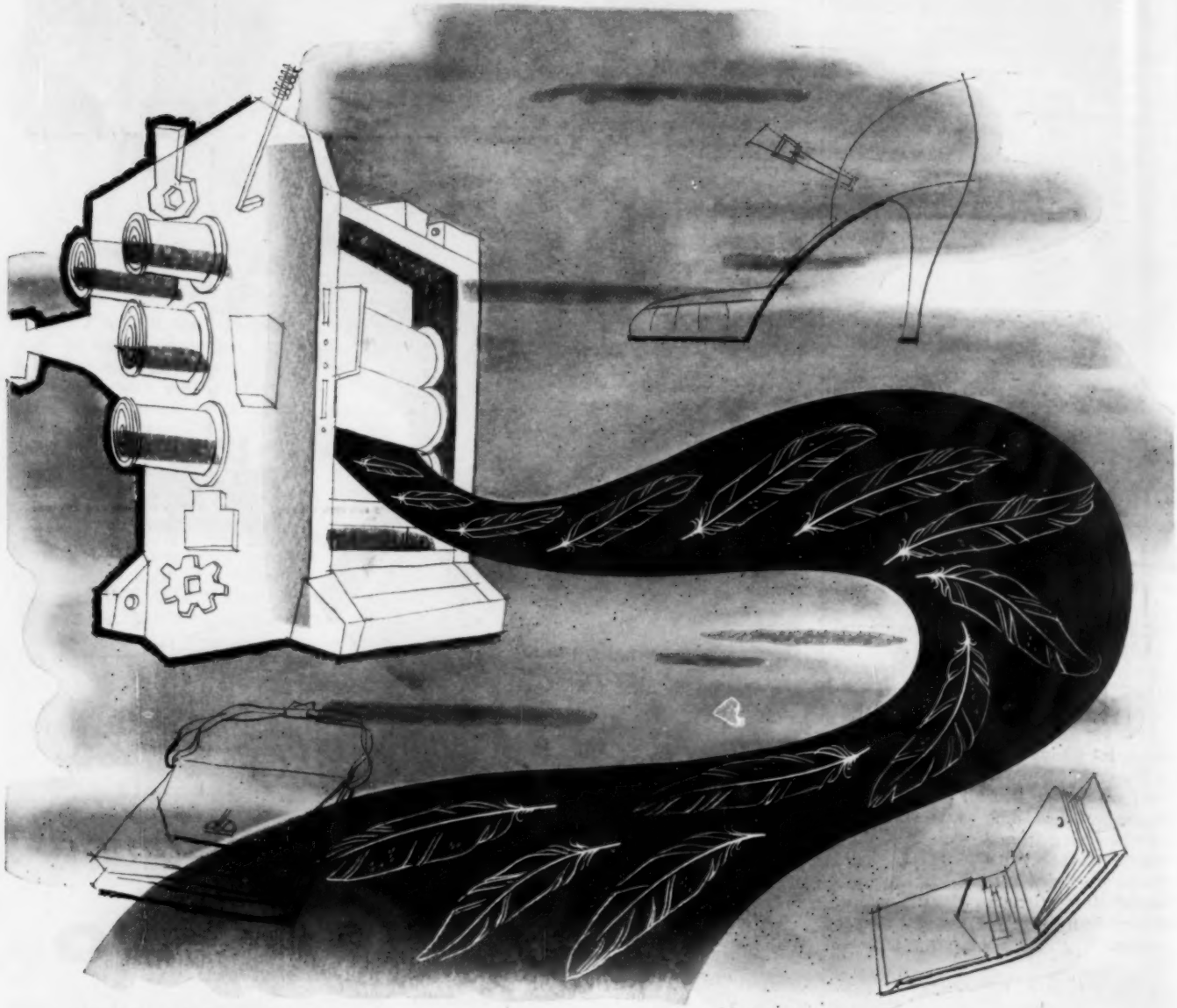
PLENCO PHENOLICS
FOR BETTER PLASTIC PRODUCTS

PLASTICS ENGINEERING COMPANY Sheboygan, Wisconsin

Serving the plastics industry in the manufacture of high grade phenolic molding compounds, industrial resins and coating resins.

VYGEN PVC RESIN

Ideal for stylish, light embossing



The trend toward light-embossed vinyl sheeting for fashion items could create serious production problems in your plant. Light-embossing on sheets calendered of ordinary vinyl resin often causes lumps and troublesome surface imperfections. You can eliminate those profit-wrecking problems with VYGEN® PVC resins. VYGEN PVC resins have excellent heat stability during processing (prevents color variations), closely-controlled molecular weight (assures processing uniformity), and a very uniform rate of solvation (minimizes surface imperfections).

Be sure you can supply the high-quality, light-embossed vinyl sheeting required for handbags, shoes, novelties and other uses — be sure you use VYGEN PVC resins. For more detailed information on the VYGEN resin to use in your operation, write to *The General Tire & Rubber Company, Chemical Div.*

Creating Progress Through Chemistry

THE GENERAL TIRE & RUBBER COMPANY

CHEMICAL DIVISION · AKRON, OHIO

Chemical Division GENERAL THE GENERAL TIRE & RUBBER CO. VYGEN

New Literature

Write item numbers on Readers' Service card to obtain copies.

"Physical Properties of Carbide & Carbon Chemicals." F-6136. Carbide & Carbon Chemicals Co. 24 pages. More than 335 organic chemicals are described, including 21 new items. Condensed data on applications are presented, and physical properties are given in tabular form. An alphabetical index is included.

Readers' Service Item L 1

"Here's Big News." Haveg Industries, Inc. 4 pages. This bulletin describes a new design service offered by the company, which covers corrosion-resistant heat exchangers, chlorine coolers, falling film absorbers, and towers of all types. Also covered are some of the properties of Haveg's plastic resins, and the applications for which they are designed.

Readers' Service Item L-2

"Plastics in the Home Building Industry." Bakelite Co. 16 pages. This illustrated booklet, aimed at the builder, suggests applications for plastics in the home. It is divided into sections as follows: foundations, framing, finishing, built-in equipment, and mechanical equipment.

Readers' Service Item L-3

"National Basic Materials Comparator Chart." National Vulcanized Fibre Co. 4 pages. The chart lists, compares, and evaluates the various physical properties of laminated plastic and vulcanized fibers. Thirty-four basic grades of fibers and phenolic laminates are listed, and 23 material-property ratings given for each grade.

Readers' Service Item L-4

"The VC Series of Gravure Vinyl Ink Concentrates for Printing on Vinyl Film and Sheeting." Bulletin No. 340. Claremont Pigment Dispersion Corp. 2 pages. Properties, uses, and prices are listed for these ink concentrates.

Readers' Service Item L-5

"Fabricated Parts and Components—Management Decision for Profit." National Vulcanized Fibre Co. 12 pages. This illustrated booklet deals with the cost advantages gained by dealing with a single source for fabricated parts made from vulcanized fibers, phenolic laminates, nylon, and combinations of these materials.

Readers' Service Item L-6

"Plaskon Resins for Shell Molding." Barrett division, Allied Chemical & Dye Corp. 32 pages. This booklet describes the shell molding process for casting metals, with particular emphasis on the foundryman's problems. Design and cost considerations are discussed, as are available types of molding machinery, gating techniques and precautions, pattern design, resin bonding of shell molds, special metals handling, and methods of forming shell cores and molds.

Readers' Service Item L-7

"Haveg Corrosion Resistant Equipment." C-14. Haveg Industries, Inc. 32 pages. This catalog covers the firm's entire line of resin formulations, Teflon-forming equipment, piping, fume ducts, tanks, towers, heat exchangers, pressure and vacuum equipment, and agitators. Data are also given on Haveg chemically-resistant cements and design services.

Readers' Service Item L-8

"1,5-Pentanediol." F-40006. Carbide & Carbon Chemicals Co. 6 pages. Properties, shipping data, chemical reactivity, and applications are given base chemical, which is used in the manufacture of polyesters, plasticizers, lubricants, and solvents.

Readers' Service Item L-9

"2-Methyl-5-Ethyl Pyridine." F-7621. Carbide & Carbon Chemicals Co. 6 pages. Specifications, shipping data, and applications are given for this chemical intermediate, used in the manufacture of synthetic fibers, synthetic rubbers, and solvents.

Readers' Service Item L-10

"Van-Cor Pipe, Fittings, and Valves." Colonial Plastics Mfg. Co. 16 pages. This catalog describes the firm's line of unplasticized PVC piping; normal-impact Van-Cor 1, and high-impact Van-Cor 2. Physical properties, chemical resistance, dimensions, flow charts, and assembly and installation data are given.

Readers' Service Item L-11

"Dielectric Oven." Bulletin 56-E. Young Brothers Co. 4 pages. The principle of dielectric heating is explained, and the distinctive features of the company's line of dielectric ovens are outlined and illustrated.

Readers' Service Item L-12

"The Evaluation of Carbon Black Dispersion in Polyethylene Masterbatches." M. E. Jordan, M. M. Chappuis, and F. R. Williams. Cabot Research Laboratories. 7 pages. This paper outlines a procedure for determining the degree of carbon black dispersion in polyethylene masterbatches. The material is added to screen out ultra-violet light in outdoor applications. The described procedure is reported to be superior to the older "squeeze-out" technique, and is designated as the microtome technique.

Readers' Service Item L-13

"Evenglo Polystyrenes." Technical Bulletin C-6-162. Koppers Co., Inc. 20 pages. This illustrated bulletin describes in detail the Evenglo series of specially pigmented polystyrenes, strong and lightweight materials for lighting applications. Light-transmission characteristics, physical properties, design considerations, and methods of fabrication are discussed.

Readers' Service Item L-14

"Black General Purpose 12902 Molding Compound." General Electric Co., chemical materials department. 4 pages. A fast-cure cycle is the prime feature of this one-stage phenolic compound for automatic molding. Powder and molded properties are listed, and processing data are given.

Readers' Service Item L-15

"Black 12920 and Brown 12921 General Purpose Phenolic Compounds." General Electric Co., chemical materials department. 4 pages. Powder and molded properties are listed for the materials, together with data on finishing, curing, preforming, preheating, mold temperatures, and applications.

Readers' Service Item L-16

"Epoxy Resin Curing Agents." F-8665. Carbide & Carbon Chemicals Co. 8 pages. This bulletin lists properties and formulations for diethylene triamine, triethylene tetramine, dimethylamino propylamine, diethylamino propylamine, and alpha-methylbenzyl dimethylamine. The materials are used as epoxy curing agents, and impart varying pot-life duration.

Readers' Service Item L-17

"1957 Condensed Reference File." Bakelite Co. 16 pages. Intended as a reference guide for designers, engineers, and planners, the booklet lists distinguishing characteristics and fabricating techniques for Bakelite's six major plastics. More than 80 photos are used to illustrate applications for polyethylenes, vinyls, phenolics, styrenes, epoxies, and polyesters.

Readers' Service Item L-18

NEW DU PONT NYLON FORMULATION

Zytel® 42

OFFERS

- superior extrusion characteristics
- superior toughness and melt stiffness

"ZYTEL" 42 IS DIFFERENT

ZYTEL 42 is specially formulated for extruding and blow-molding. Not only does it offer superior viscosity and flow properties in the molten state, but in addition to these unique properties, it retains the outstanding qualities of high strength, abrasion resistance and high softening temperature found in ZYTEL 101. Further, ZYTEL 42 offers higher impact strength, and its superior melt stability now makes control of the extrusion possible.

APPLICATIONS OF EXTRUDED "ZYTEL" 42

This new formulation can be used for extruded shapes of many varieties as well as for tubing, rod, pipe and laminates. Extruded sheeting of ZYTEL 42 is ideal for stamped items, and film of ZYTEL 42 can be laminated to paper, foil and to other films. Its greater melt stiffness makes it possible to blow-mold tough, strong bottles of ZYTEL 42, without special equipment, for containers for cosmetics, pharmaceuticals and aerosol sprays. For instance, new high-style, dry-colored bottles that are blow-molded are so tough they bounce when dropped. Heat tests have proved their ability to withstand high internal pressures without rupture or valve breakage.

OTHER APPLICATIONS

In other applications, extrusions of ZYTEL 42 have been used to make such items as washers, aircraft grommets, and bearings. Tubing of ZYTEL 42 is used in a unique automobile lubrication network which the motorist operates by pushing a button. ZYTEL 42 proves its ability to withstand extreme flexing on a wind-up reel used as an actuator rod inside a retractable auto radio antenna.

PROPERTIES OF "ZYTEL" 42

This table shows some of the superior properties of ZYTEL 42. In general, articles and shapes extruded of it are characterized by form stability at high temperatures, toughness, abrasion resistance and chemical resistance. ZYTEL 42 can readily be handled by the usual thermoplastic extrusion techniques.

PROPERTY	ZYTEL 42
Tensile strength	12,200 lb/sq. in at 73°F.
Elongation	150% at 73°F.
Stiffness	200,000 lb/sq. in at 73°F.
Hardness, Rockwell	R118
Flow temperature	480°F.
Heat distortion temp.	
264 lb./sq. in.	150°F.
66 lb./sq. in.	360°F.

Specify the new Du Pont ZYTEL 42 for extruded and blow-molded products and take advantage of the special properties this resin has to offer.

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I am interested in evaluating this material for_____

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*Company*_____ *Position*_____

*Street*_____

*City*_____ *State*_____

*Type of Business*_____

IN CANADA: Du Pont Company of Canada (1956) Limited P. O. Box 660, Montreal, Quebec.

Book Reviews

"Symposium on Speed of Testing of Non-Metallic Materials." ASTM Special Technical Publication No. 185. American Society of Testing Materials, 1916 Race St., Philadelphia 3, Pa. Paper, 6 by 9 inches, 86 pages. Price: $2.50; $1.85 to members.

This booklet contains eight papers which were presented at the 48th annual meeting of the Society in Atlantic City, N. J., on June 29, 1955. The symposium covered testing speeds ranging from very slow to very rapid, but makes no claim of being the last word in this very extensive field. Numerous graphs, charts, and photographs are included.

Titles of the eight papers are as follows: "Influence of Rate of Loading on the Strength of Wood and Wood-Base Materials," "Effect of Speed of Testing on Glass," "Effects of Speed in the Mechanical Testing of Plastics," "Preliminary Data Obtained in Constant Strain Rate Tests," "Stress-Strain Relationships in Yarns Subjected to Rapid Impact Loading," "Effect of Speed of Testing on the Tension Test of Elastomers and Hard Rubber," "Review of Data on Effect of Speed in Mechanical Testing of Concrete," and "Notes on Effect of Speed of Testing on Tensile Strength and Elongation of Paper."

"Teflon." C. A. Roberts, Marine Corps Development Center. Order PB 121286 from OTS, U. S. Department of Commerce, Washington 25, D. C. Paper, 46 pages. Price, $1.25.

Teflon coatings were found to provide suitable protection for weapons in long-term storage despite a total lack of care. The coatings were applied as a water suspensoid by air or electrostatic spray, and air dried. The films resisted absorption of any liquid, and adherence of ice, dust, and dirt. Original coatings afforded lubrication for small arms under all conditions for an almost indefinite period. Firing of coated projectiles actually improved the condition of the barrels and cleanliness of firing chambers.

"Development of a Case Liner for Long-Term Outdoor Storage." C. E. Hrubesky, R. A. Aubey, and A. Hyttinen, Forest Products Laboratory, U. S. Department of Agriculture for Army Ordnance Corps. Order PB 111916 from OTS, U. S. Department of Commerce, Washington 25, D. C. Paper, 33 pages. Price, $1.00.

Various barrier materials were tested to determine their effectiveness as case liners for boxes which would be stored outside. Although none met all requirements, the following three showed considerable promise: 2-mil polyethylene film between two sheets of 60-pound creped kraft coated on one side with a 2-mil polyethylene film; 3-mil polyethylene on 60-pound kraft; and 1-mil aluminum foil laminated between a 3-mil film of polyethylene and 44/40 cotton scrim. Laboratory-controlled performance, cyclic-exposure, and rough handling, as well as preparation of specimens for outdoor exposure, were described.

"Plastic Roller Bearing Race Separators—Critical Operating Properties of Plastics." A. Gremer, Schweinfurt, Germany. Translated by Science Translation Service, University of Alabama, for Bureau of Ships, U. S. Navy. Order PB 121-363 from OTS, U. S. Department of Commerce, Washington 25, D. C. Paper, 25 pages. Price, 75¢.

German industry has substituted plastics for metal in bearings which are subjected to such unfavorable conditions as inadequate lubrication, high local-loading due to improper installation, and excessive revolutions per minute. With few exceptions, the plastic bearings exhibited better critical properties than bronze or steel, the materials commonly used for roller bearing race separators. Five different plastic materials were used in the tests.

"Fatigue Properties of Various Glass Fiber-Reinforced Plastic Laminates." K. H. Boller, Forest Products Laboratory for Wright Air Development Center. Order PB 121500 from OTS, U. S. Department of Commerce, Washington 25, D. C. Paper, 96 pages. Price, $2.50.

Fatigue properties for six standard and four heat-resistant laminates were determined at a frequency of 900 cycles per minute. The report includes 53 S-N curves, representing fatigue data between 1,000 and 10-million cycles. These illustrate the effect on fatigue strength of such variables as notch, moisture, fabrics, resins, mean-stress levels, angles to warp, and temperatures up to 500° F. Data indicate that elevated temperatures tend to reduce fatigue strength of both standard and heat-resistant plastic laminates. The effect of elevated temperature tends to decrease with an increasing number of cycles.

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Abstracts of Important Articles

Materials

"New Resins for Plastic Films," M. Thibaut, *Ind. Plastiques Mod.*, 8, 5, 36 and 8, 6, 33 (May and June 1956).

Taking polyethylene as an example, the author examines a number of relations between molecular structure and resulting properties as the effects of amount of short-chain branching on crystallinity, molecular weight, and molecular distribution curve. In addition, the relationship of viscosity and breaking load, elongation and density, breaking load and elongation as function of temperature, and permeability as a function of temperature also are discussed. The special qualities of Ziegler-process irradiated polyethylene and polyethylene terephthalate are dealt with, as well as those of PVC and polyfluoroethanes. (In French.)

"Epoxy Resins; Manufacture, Properties, and Applications," M. Rivat-Lahousse, *Ind. Plastiques Mod.*, 8, 6, 1 (June 1956).

In addition to their employment in the manufacture of varnishes and coatings, epoxy resins are finding increasing use in the production of laminates with paper, fabrics, fiber glass, and metals, also as adhesives and as casting resins. Their applications are briefly discussed. (In French.)

"The Effect of Irradiation on High Polymers," H. Kronert, *Plaste u. Kautschuk*, 3, 8, 169 (Aug. 1956).

Review of the work done, chiefly in the United States and Britain, on irradiation of rubber and plastics with radio-active means. Cross-linking and polymerization effects are considered. (In German.)

"Determination of the pH Value of Aqueous Suspensions," H. Reuther and E. Rosenbaum, *Plaste u. Kautschuk*, 3, 5, 11 (May 1956).

In determining pH values of suspensions of finely dispersed inert materials (fillers, pigments, etc.), a difficulty is that the values for the suspension differ from those of the filtrate. To obtain reproducible results, Lenz proposed a uniform method using 10% suspensions, when the most probable value would be that which remained constant after 30-60 minutes. Since not all materials give suitable 10% suspensions, it is suggested that 2% suspensions and glass electrodes be used. Experiments seem to indicate that the difference in pH values of suspension and filtrate is due to degree of diffusion, and that hydrogen ion activity is a factor. (In German.)

"Formation of Water of Condensation During High-Frequency Pre-heating," H. Meichsner and P. Flemming, *Plaste u. Kautschuk*, 3, 8, 182 (Aug. 1956).

The role of the air-gap is explained, and the relationship of air gap, pre-heating temperature, and pre-heating time investigated. It is attempted to clarify the divergencies from some of the results obtained by Guzetti in similar tests. Research aimed at quantitative determination of the amount of condensation water precipitated on the upper electrode found that when this amount reaches 100 mg. (in the tests), arcing may take place. It is shown that formation of condensation water can be kept within tolerable limits by heating the upper electrode to 90° C. The same results could not be achieved by passing air between the electrodes to divert water vapor formed during pre-heating. (In German.)

"Surface Degradation of Perspex by Ultrasonic Radiation," N. H. Langton, *Plastics (London)*, 21, 225, 118 (June 1956).

As a corollary to work in progress at the British National College of Rubber Technology on the degradation of polymers in solutions of polystyrene or polymethyl methacrylate irradiated by ultrasonics, a study was begun on degradation of surfaces of solid high polymers exposed to ultrasonic radiation. Surface charges occurring in Perspex were observed through an electron microscope, and some of the results obtained are described. Since the changes are very complex and could be caused by many factors, no attempt is made to explain them. Further work is continuing in order to distinguish between purely thermal phenomena and those due to ultrasonic degradation. Attempts will be made to correlate ultrasonic surface modification with other physical properties of the surface.

"Radiation in the Plastics Industry," R. Roberts, *Plastics (London)*, 21, 225, 116 (June 1956).

At Harwell, it is expected that a steady source of one billion curies of radiation activity will be available by the end of 1956 so that industrial processing by utilizing radiation becomes feasible. The author reviews investigations to date on the use of radiation to initiate polymerization in both the solid and emulsion states, and to polymerize fluorine monomers. He also calls attention to the work by Chapiro at the Radium Institute, Paris, on graft polymerization by irradiation. In discussing radiation modification of plastics and elastomers, he touches on the economics of the process and stresses that efforts in the plastics field should be directed toward the discovery and development of new materials and, in particular, high-temperature plastics.

"Progress in the Chemistry and Processing of Polyesters," M. Fourcade, *Ind. Plastiques Mod.*, 8, 6, 36 (June 1956).

After a review of the synthesis of polyesters, the basic materials employed, the way in which diacids and glycols are combined to obtain different types of polyesters and the influence of molecular structure, the author considers the different kinds of polyesters, particularly of the maleic acid type and its copolymerization with styrene. The possibilities of copolymers with other monomers are briefly mentioned, including the proposed use of allyl tricyanurate or allyl phthalate to improve temperature resistance, and a patented French process for obtaining polyesters with what is claimed to be perfect adhesion to other macromolecules by combining the former with suitable monomers. (In French.)

"Mains Frequency Electrical Induction Heating for the Plastics Industry," W. E. Lorton and M. A. Craske, *Plastics*, 21, 226, 172; 21, 227, 204 (July & Aug. 1956).

The method of induction heating is dealt with in this article. Induction heating is claimed to give improved results in heating molds and platens for injection and compression molding, as well as in extrusion molding. Examples of its application in these molding techniques are given.

"Properties of Vestolen, a Ziegler Low-pressure Polyethylene," G. Wick and H. Konig, *Kunststoffe*, 46, 10, 460 (Oct. 1956).

Vestolen can have molecular weight up to 1,000,000. The present article deals with material of molecular weight from 70,000-200,000. Since the physical properties of Vestolen are comparable with those of low-pressure polyethylenes, the authors take up chiefly its special characteristics, such as aging phenomena, stress-cracking, and the effect of carbon black as stabilizer. The production of Vestolen pipe, socket joints, and various injection and transfer molded parts is described. The importance of processing temperature in the manufacture of Vestolen piping is stressed. It is recommended that such piping should not be used under pressure at temperatures over 30° C., since it undergoes marked deformation under these conditions, in contrast to piping of Vestolit, which withstands 60° C. New studies will determine whether Vestolen can be improved in this respect. (In German).

Equipment

"Electronic Instruments in the Plastics Industry," O. Negg and J. Wyatt, *Plastics*, 21, 228, 218 (Sept. 1956).

Various electronic instruments are described, including those used to control level of liquids and powders in mixing

hoppers; thermostats to control barrel temperature of extruders; recorder-indicators for temperature measurement and control; and a low-pressure transmitter for use in vacuum-forming. Details also are given of an instrument system for large-scale scanning of temperature points in a plant.

"Three Position and Stepless Controls for Extruders," J. A. Hartnett, *Plastics*, 21, 228, 234 (Sept. 1956).

Instruments to control electric heating, such as thermostats, variable transformers, and the simpler pyrometers, are evaluated. Newer systems, such as the three-position pyrometer controller and the stepless temperature controller, are considered.

"Vacuum-Forming Machine," A. Hoeger, *Oesterr. Plastic Rundschau*, 3 & 4, 28 (July 1956).

Vacuum I, a positive and negative, twin-table vacuum-forming machine, is the first of its kind designed in Austria. It is built along American lines, but is adapated to European requirements and has certain patented improvements. The infra-red heater is mounted so as to swing about a column centrally located on one side of the machine. This construction is said to render the two-table model really efficient, to permit complete utilization of heat radiations, and to make a pre-heater unnecessary. Proper heating of the thermoplastic sheet is insured by a patented thermal measuring device which indicates heat conduction as a relative measure of heat absorption, and eliminates the need for air-conditioning. (In German).

Processing

"Experiences in After-Treatment of Polyamide Moldings. Part II. Physical Surface Treatment," B. Olsen, *Kunststoffe*, 46, 11, 540 (Nov. 1956).

In this part, new methods are described in which the transparent marginal areas of injection-molded polyamide parts are given an optically visible, crystalline structure.

"Granulated, Unplasticized PVC," G. Wick and H. Konig, *Kunststoffe*, 46, 11, 533 (Nov. 1956).

An important factor in the processing of granulated, rigid PVC is the shape of the grains. It has been found that in producing rigid PVC pipe, blown film, bottles and profiles by extrusion or injection molding, the cylindrical grains (usually 3 mm. in diameter and 3 mm. long) have too high a density for their surface area, and can be replaced advantageously by lentil-shaped grains 1-2 mm. in size. The method and machinery requirements for producing such lentil-shaped granulates are described, as well as construction materials for screws, cylinders, and die-heads of extruders; for the screws and cylinders,

"Custom Built for Plastics"
Gardsman by WEST
TUBELESS* TEMPERATURE-CONTROLLERS

Model JP Series
PROPORTIONING Controllers
This time-proved unit is widely used for closer control than the basic On-Off system permits. JP *anticipates* temperature changes, tends to stabilize the system to desired temperature, makes new harder-to-mold materials a simple production job.

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heat-treated steels containing 13-16% chromium are recommended and a clearance of 0.5 mm. between internal diameter of cylinder and external diameter of screw is advised, combined with a stepped-up number of screw revolutions. Hastelloy B-type alloys are preferred for the die heads. Of the various types of Huls granulated rigid PVC, a few contain a tin stabilizer, but the rest have either MOH (manganese hydroxide) or I (alpha-phenyl-indol) stabilizers. (In German).

"Vacuum Forming," I. A. Pittman, *Austral. Plastics*, 12, 132, 7 (July 1956).

The various processes followed in sheet forming the materials available in Australia and America, and the relative consumptions in the two countries are compared. Mold design, molding faults, trimming, and finishing are dealt with, as well as applications and economics of the method. Vacuum molding is compared with injection molding, and future trends in machines and materials are briefly mentioned.

Applications

"Water-soluble Plastics and Aqueous Dispersions of Plastics for the Textile Industry," K. Spensel, *Kunststoff-Rundschau*, 3, 6, 196 (June 1956).

Plastics and dispersions for the textile industry are listed under their trade names together with brief descriptions of their constitution and uses. (In German).

"A New Organo-Silicon Finish for Glass Cloth," P. A. J. Gate, *Rubber & Plastics Age*, 37, 9, 603 (Sept. 1956).

Experimental Silicone D 9132, a new organo-silicon finish developed by Dow-Corning and said to be easier to apply than vinyl-trichlorosilane, was given a preliminary evaluation in the laboratories of Midland Silicon, Ltd. From a comparison of laminates of a polyester, a phenolic, and an epoxide resin, treated with D 9132 and vinyltrichlorosilane, respectively, it would appear that the former gives better results with phenolic laminates, but that it is slightly inferior to the vinyltrichlorosilane with epoxide and polyester resins.

"Ion-Exchange Resins in Analytical Chemistry," J. Calderon Martinez, *Rev. de Plasticos*, 7, 40, 178 (July-Aug. 1956).

The chemical properties and chemical structure of typical ion-exchange resins (phenol-formaldehyde, polystyrene, and polymethacrylate) are briefly discussed, and their use in certain analytical procedures (as chromatography and adsorption of non-electrolytes) is explained to give a general idea of the possibilities of ion exchangers in analytical chemistry. (In Spanish).

"The Combination of Plastic Foils for Packaging Purposes—A Study," R. Heiss, *Kunststoffe*, 46, 11, 506 (Nov. 1956).

After briefly reviewing the considerations on which selection must be based when combining packaging materials, the author deals particularly with the question of how a deficiency in a plastic can be compensated for by uniting with another plastic in which this deficiency either is absent or much less apparent. He lists suitable combinations of plastic films and the advantages to be expected from them. (In German).

"Acrylics for Street Lighting," P. N. Collins, *Plastics*, 21, 226, 149 (July 1956).

After discussing the general principles of street lighting, the author considers in detail the development of acrylic materials for application in this field dealing also with the question of lantern design and the requirements for main road and side road lighting. He foresees the continued use of acrylic sheet for special-purpose lanterns, but finds the trend of development to be toward injection molded enclosures up to six foot now that the size of injection presses has been increased.

Request for copies, reprints, or further information on any article abstracted in this department should be addressed to the publisher of the magazine where the article appeared. The publishers and their addresses are given below:

"ASTM Bulletin"
American Society for Testing Materials
1916 Race St., Philadelphia 3, Pa.

"Australian Plastics"
Australian Trade Publications, Ltd.
171 Sussex St., Sydney, Australia

"British Plastics"
Iliffe & Sons, Ltd.
Dorset House, Stanford St.
London S.E.I, England

"Canadian Plastics"
341 Church St., Toronto, Ont., Canada

"Chemical and Engineering News"
1155 Sixteenth St. N.W.
Washington 6, D. C.

"Hule Mexicano y Plasticos"
Filomeno Mata 13-11, Mexico, D.F.

"Industrial and Engineering Chemistry"
1155 Sixteenth St. N.W.
Washington 6, D. C.

"Industries des Plastiques Modernes"
Les Publications Techniques Associees
40 Rue du Colisee, Paris 8e, France

"Kunststoffe"
Carl Hanser Verlag
Leonard Eck Str. 7, Munich 27,
Germany

"Kunststoff-Rundschau"
Brunke Garrels, Verlagsbuchhandlung
Borgfelder Strasse 83, Hamburg 26,
Germany

"Materials and Methods"
Reinhold Publishing Corp.
430 Park Ave., New York 22, N. Y.

"Materie Plastiche"
Via Farneti 8, Milan, Italy

"Matiéres Plastiques"
Galerie du Center, Bloc 3
Rue des Fripiers, Brussels, Belgium

"Mechanical Engineering"
American Society of Mechanical Engineers
29 W. 39th St., New York 18, N. Y.

"Modern Plastics"
575 Madison Ave., New York 22, N. Y.

"Oesterreichische Plastic-Rundschau"
Ployer & Co.
Aegidiengasse 5, Vienna 6, Austria

"Plaste und Kautschuk"
Veb Verlag Technik
12 Unter den Linden
Berlin N.W.7, Germany

"Plastic"
Danish Technical Press
31 Vester Farimogsgade
Copenhagen 5, Denmark

"Plastica"
Kunststoffeninstituut T.N.O.
Julianalaan 134, Delft, The Netherlands

"Plastics"
Temple Press, Ltd.
Bowling Green Lane, London E.C.I,
England

"Plastics World"
Cleworth Publishing Co., Inc.
22 W. Putnam Ave., Greenwich, Conn.

"Plastiques Informations"
94 Rue Saint-Lazare
Paris 9e, France

"Plastverarbeiter"
Verlagsgec. m.b.H.
Herxheim b. Landau/Pfalz, Germany

"Poliplasti"
E.T.A.S., Via Andrea Mantegna 6,
Milan, Italy

"Revista de Plasticos"
Inst. "Alonso Barba"
Serrano 119, Madrid, Spain

"Revue Générale des Matiéres Plastiques"
196 Ave. Jean-Jaures, Paris 19e, France

"Rubber and Plastics Age"
Rubber and Technical Press, Ltd.
Tenterden, Kent, England

"SPE Journal"
Security Bank Bldg., Athens, Ohio

"Transactions of the Plastics Institute"
9 Mandeville Place, London W. I,
England

Patent Digest

Materials

Stabilization of Polystyrene with N,N'-Di-β-Naphthyl-P-Phenylenediamine. No. 2,759,905. Ernest H. Wood, Westfield, N. J., and James R. Wilkinson, Milwaukee, Wis. (to Union Carbide & Carbon Corp., New York, N. Y.).

A homopolymer of styrene is stabilized against light and heat through the addition of 0.01-10% by weight of the above-mentioned chemical.

New Condensation Products of Guanyl-Melamines with an Aldehyde. No. 2,759,907. Otto Albrecht, Neuwelt, Switzerland (to Ciba, Ltd., Basel, Switzerland).

A water-soluble salt of guanyl-melamine is reacted with formaldehyde to form a dry condensation product.

Polymerized Compositions. No. 2,759,910. John Noel Milne, Epsom Downs, and Robert George Denton Crick, West Ewell, England (to Distillers Co., Ltd., Edinburgh, Scotland).

An alpha-beta ethylenically-unsaturated carboxylic acid is interpolymerized with an alpha-beta ethylenically-unsaturated nitrile in the presence of a third copolymerizable compound. The temperature is kept at 100-200° C. until cross-linking by the formation of diacylamino groupings has occurred.

Preparation of Polyvinyl Alcohol with Water Washing of Gel. No. 2,759,914. William O. Kenyon, George P. Waugh, and Erle W. Taylor, Rochester, N. Y. (to Eastman Kodak Co., Rochester, N. Y.).

Polyvinyl acetate is deacetylated in an alcohol solution through the use of an alkali-deacetylating catalyst. This process produces a polyvinyl alcohol in gel form, which is insoluble in water under 50° C. The gel is then washed with water under that temperature to free the polyvinyl alcohol from the residual catalyst and other reaction byproducts.

Cellulose Acetate-Butyrate Compositions Containing 3-Methoxy Butyl Myristate. No. 2,763,562. Lester W. A. Meyer and Margaret H. Broyles, Kingsport, Tenn. (to Eastman Kodak Co., Rochester, N. Y.).

This compound, adapted for molding at elevated temperatures and pressures, comprises 100 parts by weight of cellulose acetate-butyrate and 2-22 parts by weight of 3-methoxy butyl myristate.

Pyrolysis Process for Preparing Hexafluoropropene from Tetrafluoroethylene Polymer. No. 2,759,983. Joseph S. Waddell, Clifton, N. J. (to E. I. du Pont de Nemours & Co., Inc., Wilmington, Del.).

Polytetrafluoroethylene is continuously fed into a reaction zone which is heated to a maximum pyrolysis temperature of 750-960° C. The gaseous pyrolysis mixture containing hexafluoropropene can be withdrawn from the reaction zone in 0.3-5 seconds, depending on the temperature and pressure.

Acrylonitrile Polymers Modified with Amylose Ethers. No. 2,763,627. Hugh J. Hagemeyer, Jr., Kingsport, Tenn. (to Eastman Kodak Co., Rochester, N. Y.).

About 70-90 parts by weight of acrylonitrile are heated with 10-30 parts by weight of a partially-hydrolyzed amylose acetate in an aqueous medium, under a nitrogen atmosphere, and in the presence of a peroxide polymerization catalyst.

Organotin Oxide-Ester Reaction Products and Vinyl Chloride Resins Stabilized Therewith. No. 2,763,632. Ernest W. Johnson, Westfield, N. J. (to Metal & Thermit Corp., New York, N. Y.).

Approximately 0.5-3% of a reaction product of a hydrocarbontin oxide and a hydrocarbon ester of a carboxylic acid is intimately dispersed throughout a vinyl chloride resin composition as a stabilizing agent.

Melamine Hardenable Ternary Condensation Products. No. 2,763,649. Otto Albrecht, Neuwelt, and Armin Hiestand, Binningen, Switzerland (to Ciba, Ltd., Basel, Switzerland).

A mol of hexamethylolmelamine methyl ether is reacted with a mol of a monohydric alcohol at a temperature of 110-200° C., and under reduced pressure. The reaction product is condensed at a temperature of 70-100° C., with a mol of glycolic or thioglycolic acid.

Manufacture of Methylstyrene. No. 2,763,702. James L. Amos, Midland, and Kenneth E. Coulter, Bay County, Mich. (to Dow Chemical Co., Midland, Mich.).

Toluene is ethylated in the presence of a Friedel-Crafts catalyst to form a mixture of unreacted toluene and the three isomeric monoethyl toluenes together with polyethyltoluenes. The mixture is separated by fractional distillation to obtain a fraction rich in toluene, a fraction rich in ortho-ethyltoluene, a fraction rich in meta- and para-ethyltoluenes, and a fraction rich in polyethyltoluenes. All but the fraction rich in meta- and para-ethyltoluenes are recycled, and this single fraction is vaporized and passed through a dehydrogenation zone at a reaction temperature which would form meta- and para-methylstyrene. The effluent vapors are cooled to condense the aromatic products, and fractional distillation is then employed to separate the styrenes from the unreacted ethyltoluenes.

Printed copies of patents are available from the Commissioner of Patents, Washington 25, D. C. Price, 25c each.

—The Editor

Process for Melamine Production. No. 2,763,651. Robert A. Harman, Rowayton, Conn. (to Allied Chemical & Dye Corp., New York, N. Y.).

Melamine is obtained by heating at least one of the following group of compounds: urea, ammonium cyanate, biuret, cyanuric acid, ammelide, and ammeline with calcium cyanamide. Temperature is maintained at about 200° C., and the reactants are kept in contact with carbon dioxide and ammonia at pressures of at least 500 psi. absolute. Melamine is then recovered.

Resinous Nitromethane Reaction Products. No. 2,760,951. Harold F. Park, East Longmeadow, and Robert J. Anderson, Springfield, Mass. (to Monsanto Chemical Co., St. Louis, Mo.).

About 0.5-3 mols of formaldehyde are reacted with one mol of a mixture of 5-90 mol percent nitromethane and 10-95 mol percent phenol. The reaction takes place in the presence of a condensation catalyst at a temperature of at least 60° C.

Acrylonitrile Polymers Stabilized with Certain Beta-Hydrocarbonoxypropionitriles. No. 2,760,950. George W. Stanton and Forrest A. Ehlers, Walnut Creek, Calif. (to Dow Chemical Co., Midland, Mich.).

The polymers consist of polyacrylonitrile and the copolymerization products of acrylonitrile and other monoethylenically-unsaturated comonomers. The copolymerization products contain at least 60% by weight of acrylonitrile and 1-20% by weight of a hydrocarbonoxyproprionitrile.

Equipment

Extrusion Apparatus. No. 2,765,492. William E. Velvel, Claymont, Del. (E. I. du Pont de Nemours & Co., Inc., Wilmington, Del.).

The body member of this film extruder has a lengthwise channel in its bottom surface, a U-shaped sleeve in its channel, and a bell-shaped end plate with tube

and ducts for passing a heat-exchange fluid around the sleeve. Other parts include a pair of orifice-defining lip members, a bottom web for defining the orifice lip, an upper arm, a lower arm with laterally-spaced holes, and spring-biased screws for engaging the upper arm.

Apparatus for Forming and Embossing Thermoplastic Materials. No. 2,765,493. Thomas W. Winstead, Baltimore, Md. (to Hedwin Corp., Baltimore, Md.).

The apparatus includes a conductive heating plate, a pivotally-mounted mold plate, a plurality of shallow grooves extending across the inner surface of the heating plate, a bleeder strip extending along the edge of the plate, and an air passage beneath the bleeder strip.

Extrusion Apparatus. No. 2,765,491. Wilhelm A. Magerkurth, Akron, O. (to National Rubber Machinery Co., Akron, O.).

The apparatus comprises a cylinder, a rotatable feed screw, a mixing zone, and an axially-extending rib on the feed screw to provide passages for the flow of material into and out of the mixing zone.

Machines for Working Rubber and Like Plastics and Compounds Having a Base Thereof. No. 2,765,490. Vittorio Zona, Milan, Italy (to Pirelli Societa per Azioni, Milan, Italy).

The machine comprises a worm-like rotor, a tubular rotor chamber with plastic inlet, and outlet, a feeding zone, a working zone, and an extrusion zone. The rotor has a helical-shaped shank portion with threads and channel; the latter varying progressively in cross-sectional area.

Apparatus for Screening Plastic Materials. No. 2,763,374. Harold Corbett, Denville, N. J. (to Reed-Prentice Corp., Worcester, Mass.).

The walls of the apparatus form an open-ended cylindrical chamber with transverse port. A stiff tube is rotatably-mounted in the chamber, and has a plurality of ports opposite a cut-away portion. A flexible screen, secured to the inner wall of the tube, overlies these ports. Other parts include a means for rotating the tube, and a means for exposing the cut-away portion and screen beyond an open end of the chamber.

Heating Cylinder for Injection Molding Machines and the Like. No. 2,766,483. Jerry C. Stokes, Erie, Pa.

The cylinder comprises a hollow, flanged section; a hollow nozzle; a heating means; a solid core with spaced holes; an elongated, cylindrical spreader; a separate means for heating the nozzle section to a higher temperature than the intermediate section; and a groove disposed in the end of the intermediate section adjacent to the nozzle.

Apparatus and Method for Making a Strip Product Capable of Being Wound Up and Provided with One Face Layer of Cured Thermosetting Resin and Product. No. 2,766,807. Joseph Marian, Saltsjobaden, Sweden.

The unit comprises a heat-insulated casing; a heated, rotatable drum; a number of small, rotatable drums located within the casing on different levels; a means for rotating the drums; a heating device; and a press.

Apparatus for Extruding Cellular Plastics. No. 2,766,481. George E. Henning, Baltimore, Md. (to Western Electric Co., Inc., New York, N. Y.).

This apparatus for extruding plastics which contain blowing agents consists of a head and chamber, an extrusion die with central aperture, a core tube with longitudinal grooves for building up back pressure, and a means for forcing the plastic through the machine.

Apparatus for Determining the Brittle Temperature of Plastic Materials. No. 2,764,889. Everett C. Hughes, Shaker Heights, Harley F. Hardman, Lyndhurst, and Melvin M. Fink, Cleveland, O. (to Standard Oil Co., Cleveland, O.).

The apparatus consists of a bath which can be maintained as a plurality of different, constant temperatures; a means for moving the material sample in a fixed path through the bath; a mandrel located in the path of the sample for contacting and bending it; and a means for measuring both the time of contact and point of break.

Processing

Method for Joining Together Sections of Plastic Pipe. No. 2,766,518. Frank X. Costanzo, Union, N. J. (to Victaulic Co. of America, Union, N. J.).

Separate sleeves of semi-rigid plastic material are inserted into the ends of the soft-plastic pipe sections. An annular gasket is seated over the two ends, which have been brought into axial alignment, and a rigid housing is seated over the gasket. Pressure is then applied to tighten the housing.

Method of Making a Shaped Laminate of Plastic Material and Base Member. No. 2,766,808. Donald J. Kleiber, Chicago, Charles J. Oshinski, Park Ridge, and Judson M. Rogers, Mundelein, Ill. (to United States Rubber Co., New York, N. Y.).

A plastic sheet, consisting of a blend of butadiene, acrylonitrile, and styrene, is laminated to the surface of a sheet metal base with irregular configuration. Air holes are provided at spaced intervals in the metal for application of vacuum, and the plastic sheet is preheated to a temperature of 200-220° F. The metal sheet is then heated to a temperature 60-100 degrees higher than the plastic sheet and coated with a heat-activated adhesive. The plastic is then applied to the metal, and vacuum is applied to shape the laminate to the desired contours.

Extrusion of Plasticized Cellulose Acetate. No. 2,758,339. John Allan, Kenneth Edwin Wright, and Bernard Shaw, Wrexham, North Wales (to British Celanese, Ltd., England).

Plasticized cellulose acetate is fed into a heated chamber whose temperature is 50-70° C. at the feed point, and 20-30° C. at the point of extrusion. The temperature midway between these points should be maintained at 100-110° C.

Process of Crimping Polyethylene Terephthalate Filaments by Heat Stretching and Heat Relaxing. No. 2,758,908. Harry J. Kolb, Wilmington, Del. (to E. I. du Pont de Nemours & Co., Inc., Wilmington, Del.).

Filaments of an ethylene glycol terephthalate polymer are stretched 2.3-3.6 times their original length at a temperature of 65-100° C. Tension of 0.1-0.9 gram per denier is then applied, and the strained filaments are placed in a hot relaxing medium at a temperature of 95-180° C. until a crimp is formed.

Method of Precipitating and Forming Hydroxy Alkyl Cellulose into Films. No. 2,763,030. Donald Robert Erickson, Kalamazoo, Mich.

Water-insoluble hydroxyethyl cellulose films are formed from a viscous solution of said material in aqueous sodium hydroxide. Carbon dioxide gas at a temperature above 70° C. is introduced to precipitate the film from solution.

Polyester-Polyisocyanate Resins Reinforced with Fibers Containing Carbonamide Groups. No. 2,763,624. Isaac L. Newell, Wethersfield, Conn. (to United Aircraft Corp., East Hartford, Conn.).

Stable, reinforced foam resins are obtained by adding short-length organic fibers to a mixture of polyisocyanates and polyester resins. These fibers are essentially long-chain polyamides containing carbonamide groups, silk, wool, hair, and casein.

Method of Producing an Optically-Clear Polyethylene Film. No. 2,763,029. Rees E. Tulloss, Jr., East Orange, N. J.

Optically-clear, self-sustaining polyethylene film or sheet with superior physical characteristics is obtained by extruding a tubing of polyethylene; inflating it while

ill soft, to realign the crystallites in a teral direction; and heating the film to sure uniform stretching. Care must be ken to keep this temperature below the elting point of polyethylene.

Method of Making a Glass Fiber Article nd Article Produced Thereby. No. 2,763,-73. Lawrence P. Biefeld, Granville, O. o Owens-Corning Fiberglas Corp., New ork, N. Y.).

Mineral fibers are bonded with a resin-us bonding material, the improvement consisting of using an anchoring agent be-ween the bonding material and the fibers. his anchoring agent is a thin film, which s the reaction product of a silane and a olyester resin, and which is different in consistency from the polyester bonding material.

Process for Making Hollow Articles with Inserts. No. 2,763,031. Paul Rekettye, Akron, O. (to Sun Rubber Co., Barberton, O.).

Rotationally-cast doll heads with set-in eyes are molded in the following way: A pin is fixed on the interior of the mold at a point where the eye is to be located; a retainer is secured on this pin, complete with locking means for gripping the eye stem; and thermosetting material is poured over the retainer and allowed to set. When the head is removed from the mold, the retainer remains permanently imbedded, ready to receive and hold the eye.

Applications

Hollow Plastic Container. No. 2,760,674. Albert E. Karp, New York, N. Y. (to Majestic Creations, Inc., Long Island City, N. Y.).

A rectangular plastic object comprising two mateable sections, one of which has a U-shaped channel rim about its periphery. A number of spring clips are secured to the interior of the U-shaped rim for gripping the exterior surface of the other section.

Seamless Plastic Ball with Integrally Formed Valve Housing. No. 2,760,775. James R. Tipton, Ashland, O. (to Eagle Rubber Co., Inc., Ashland, O.).

The ball's wall has a small opening directly into an integrally molded housing. After inflation, the housing serves as a sealing means.

Glass Reinforced Plastic Article. No. 2,758,951. James W. Case, Fairfax, Va.

A plastic product of rectilinear contour is produced by laying up a series of substantially-parallel aligned fibers, a second series of fibers of smaller cross-sectional area, and surrounding same with a plastic medium.

Method of Forming Decorated Molded Articles. No. 2,760,899. James Brisbane Cameron and Leslie Herbert Hayward, Hayes, England (to Fairey Aviation Co., Ltd., Hayes, England).

Decorated thermosetting items are made by printing absorbent paper with an oil-containing ink, degreasing, impregnating the paper with the synthetic resin solution, drying, and applying the paper to the surface of the article during molding and cure.

Plastic Mullions. No. 2,758,342. Judson G. Squires, Omaha, Nebr.

The mullion consists of a flat, flexible strip of pigmented plastic about 1/16-inch thick. A plurality of parallel glass fibers are imbedded in the strips, but not to such an extent that they would be visually evident. A coating of pressure-sensitive adhesive is applied to the strips so that they may be affixed to the window pane.

Reinforced Plastic Construction and Method of Manufacture. No. 2,758,321. John W. Westfall, Barrington, R. I. (to Anchorage Plastics Corp., Warren, R. I.).

The construction comprises a plastic shell, a number of spaced reinforcing ribs with spaced openings abutting the shell, and plastic material integral with the shell and extending around the edges of each rib and through the rib openings.

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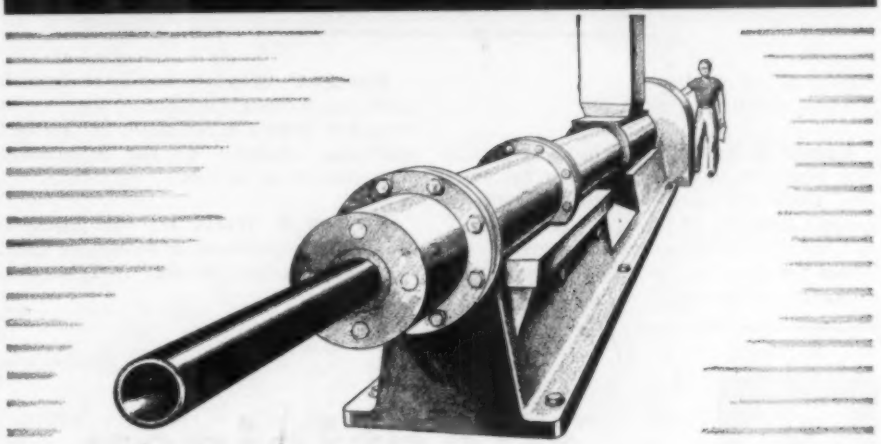

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Reds	lb.	5.60 /	6.95
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Oranges	lb.	1.12 /	2.75
Reds	lb.	1.93 /	5.25
Whites	lb.	.70 /	.85
Yellows	lb.	.78 /	5.10

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Metallics	lb.	1.09 /	1.45
Orange	lb.	.95	
Pearl	lb.	1.45	
Red	lb.	1.05	
White	lb.	.70	
Yellows	lb.	.85 /	.98

Resins & Molding Compounds

Polyethylene

Poly-Eth Hi-D 2504	lb.	.47

Names in the News
(Cont'd. from pg. 220)

Eugene J. Sullivan has been appointed vice president in charge of sales for Borden Co.'s chemical division. Currently general manager of the resins & chemicals and the Polyco-Monomer departments, he joined the firm in 1946 as a salesman of packaging adhesives.

Edward F. Bouchard has been appointed assistant director for Chas. Pfizer & Co.'s technical service department. He formerly served as manager of the department's pharmaceutical section.

Kenneth F. Webb, Jr., has joined the production department of Monsanto Chemical Co.'s plastics division at Texas City, Tex.

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TYPICAL ELECTRICAL CHARACTERISTICS		
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CALENDAR of COMING EVENTS

March 27

ASTE Plastic Tooling Symposium, Shamrock-Hilton Hotel, Houston, Tex.

April 2

SPE Kansas City Section, Millemen's Restaurant, Kansas City, Mo.

April 3

SPE New York Section, Regional Technical Conference—"Plastics in Building", Hotel Statler, New York City

April 3

SPE Western New England Section, Bradley Field, Windsor Locks, Conn.

April 4

SPE Southern California Section, Scully's Restaurant, Los Angeles, Calif.

April 4-5

SPI of Canada, Annual Conference, Ottawa, Canada.

April 8

SPE Cleveland-Akron Section, Spanish Tavern, Brecksville, O.

April 9

SPE Baltimore-Washington Section, Friendship International Airport, Baltimore, Md.

SPE Milwaukee Section, Bavarian Club, Milwaukee, Wis.

April 10

SPE Newark Section, Military Park Hotel, Newark, N. J.

April 12

Detroit Rubber & Plastics Group, Detroit-Leland Hotel, Detroit, Mich.

April 24

Reinforced Plastics Group, SPE New York Section, Tufaro's Restaurant, Corona, N. Y.

June 14

SPE Regional Technical Conference—"Plastics for Electronics", Lowell Institute of Technology, Lowell, Mass.

July 10-20

British International Plastics Exhibition, Grand & National Halls, Olympia, London, England.

Domestic Production and Sales of Plastics and Resin Material, October and November, 1956

Following are the partly estimated and revised statistics for the domestic production and sale of plastics and resinous material during the months of October and November, 1956. Units listed are in pounds, dry basis unless otherwise specified. Data on alkyds and rosin modifications have not been included since their use is primarily limited to the protective coating industry.

With the exception of Polyesters and Polyethylene, all resins lost their gains of October. Losses were slight, however, and represent a return to normal production and sales after the Christmas rush. Polyesters and Polyethylene have shown consistent gains throughout the year.

	October		November	
	Production	Sales	Production	Sales
Cellulose Plastics:[1]				
Cellulose acetate and mixed ester:				
Sheets, under 0.003 gage	1,539,399	1,504,625	1,447,542	1,580,737
Sheets, 0.003 gage and over	1,621,409	1,633,022	1,379,002	1,426,289
All other sheets, rods, and tubes	675,846	586,023	547,831	548,194
Molding and extrusion materials	9,390,246	9,574,996	9,291,376	8,930,729
Nitrocellulose sheets, rods, and tubes	395,878	378,579	365,415	365,696
Other cellulose plastics	563,509	545,968	551,028	481,048
TOTAL	14,186,287	14,223,213	13,582,194	13,332,693
Phenolic and Other Tar-Acid Resins:				
Molding materials[1]	17,971,498	16,433,338	15,235,254	15,256,558
Bonding and adhesive resins for—				
Laminating (except plywood)	5,929,989	4,409,565	5,249,695	3,842,230
Coated and bonded abrasives	1,450,098	1,652,232	1,278,380	1,493,385
Friction materials (brake linings, clutch facings, and similar materials)[7]				
Thermal insulation (fiber glass, rock wool)	5,063,153	4,849,969	5,732,143	5,356,177
Plywood	3,807,866	3,191,989	4,777,130	3,943,221
All other bonding and adhesive uses	5,150,273	5,161,433	4,416,170	4,391,813
Protective-coating resins, unmodified and modified except by rosin	2,710,870	2,070,216	2,615,877	2,053,378
Resins for all other uses	4,120,513	3,317,453	3,456,244	2,824,139
TOTAL	46,204,260	41,086,286	41,760,894	39,160,901
Urea and Melamine Resins:				
Textile-treating and textile-coating resins	3,442,454	3,577,083	3,354,669	3,223,509
Paper-treating and paper-coating resins	2,215,736	2,034,785	2,279,064	2,423,702
Bonding and adhesive resins for—				
Plywood	9,077,073	8,411,834	9,284,105	8,371,493
All other bonding and adhesive uses, including laminating	2,437,456	2,508,495	2,214,839	2,031,876
Protective-coating resins, straight and modified	3,481,430	2,888,943	3,913,653	2,913,675
Resins for all other uses, including molding	8,518,274	8,248,220	7,135,829	8,018,471
TOTAL	29,172,423	27,769,360	28,182,159	26,982,727
Styrene Resins:				
Molding materials[1]	37,734,570	35,035,188	35,538,889	31,514,672
Protective-coating resins, straight and modified	8,109,563	7,434,330	7,087,372	6,554,887
Resins for all other uses	11,054,362	11,831,623	8,928,429	9,939,926
TOTAL	56,898,495	54,301,141	51,554,690	48,009,485
Vinyl and Vinyl Chloride Resins:[3]				
Polyvinyl chloride and copolymer resins (50% or more PVC) for—				
Film (resin content)		8,580,620		7,001,772
Sheeting (resin content)		5,340,865		4,773,709
Molding and extrusion (resin content)		21,339,191		19,894,771
Textile and paper treating and coating (resin content)[8]		6,383,987		5,887,745
Flooring (resin content)		6,790,318		6,252,599
Protective coatings (resin content)		2,568,370		2,639,387
All other uses (resin content)		5,984,158		6,127,887
All other vinyl resins for—				
Adhesives (resin content)		3,231,161		3,114,607
All other uses (resin content)		10,773,464		10,241,738
TOTAL	67,176,069	70,992,134	65,900,088	65,934,215
Coumarone-Indene and Petroleum Polymer Resins	21,444,326	21,970,723	21,269,343	20,696,760
Polyester Resins	6,472,584	6,168,727	6,542,051	5,869,047
Polyethylene Resins	49,109,880	45,783,014	51,421,233	48,060,534
Miscellaneous Synthetic Plastics and Resin Materials:				
Molding materials[3], [4]	3,916,515	4,348,917	4,154,194	4,219,990
Protective-coating resins[5]	1,114,826	509,732	1,335,371	578,557
Resins for all other uses[6]	9,446,126	9,644,882	9,823,196	9,790,955
TOTAL	14,477,467	14,503,531	15,312,761	14,589,502
GRAND TOTALS	305,141,791	296,798,129	295,525,413	282,635,864

[1]Includes fillers, plasticizers, and extenders.
[2]Production statistics by uses are not representative, as end use may not be known at time of manufacture.
[3]Includes data for spreader and calendering-type resins.
[4]Includes data for acrylic, nylon, silicone, and other molding materials.
[5]Includes data for epichlorohydrin, acrylic, silicone, and other protective-coating resins.
[6]Includes data for acrylic, rosin modifications, nylon, silicone, and other plastics and resins for miscellaneous uses.
[7]Included with "All other bonding and adhesive uses."
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